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The South's Largest Successful Direct-Seeding

W. F. Mann, Jr.
and H. D. Burkhalter

DURING the winter and spring of 1958-1959, T. L. James & Company direct-seeded 18,545 acres in central Louisiana in a venture which may serve as a milestone for southern foresters. The purpose of this article is to record the story and outcome, for it is the biggest successful direct-seeding project in the South to date, and probably the largest in the country.

When the Company leased 92,000 acres of cutover land in 1957, it had to decide upon the best way of reforesting a large acreage quickly. About 85 percent of the tract was denuded, lacking both seed trees and reproduction. Fast restoration to pine was essential if the lease was to be profitable. But while the Company moved quickly, its undertaking was by no means rash. The question of whether to plant or seed was weighed carefully in the light of experience with both techniques.

The firm owned a 4-million-tree nursery and had planted seedlings for a number of years. Moreover, it had sown 1,200 acres with loblolly pine in the previous winter with excellent success and had kept posted on the outcome of other commercial seeding operations in the state. Consequently, it was in a good position to compare both methods of reforestation.

Economic considerations heavily favored seeding. Planting costs had averaged between $11 and $12 per acre and were rising each year. In contrast, many industrial landowners in the state were direct-seeding for $5 to $7 per acre; and seed costs, a major expense in direct-seeding, were decreasing with the rapid expansion of cone-processing facilities. It appeared that, on the same operating budget, twice as much acreage could be reforested

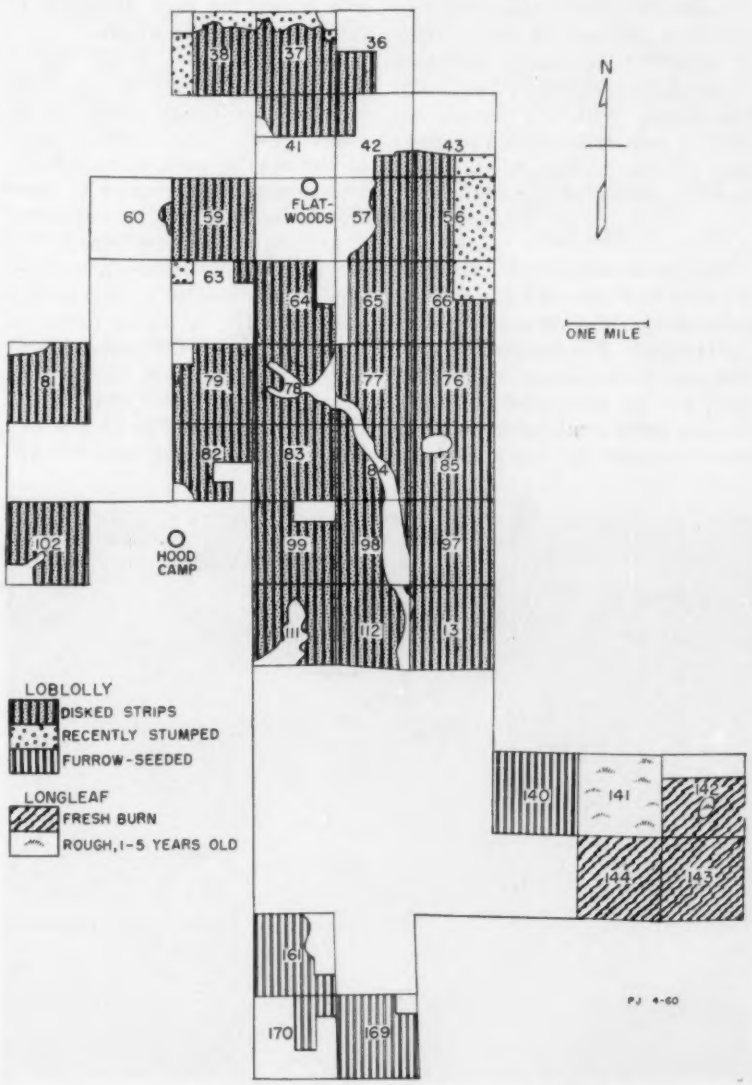

FIG. 1.—Methods of seedbed preparation.

THE AUTHORS are respectively, research forester at the Southern Forest Expt. Sta., Forest Service, U. S. Dept. Agric.; and director, Forestry Division, T. L. James & Co., Ruston, La.

each year by seeding as by planting. In addition, direct-seeding would require far less capital outlay for machines and equipment.

While seeding was clearly cheaper than planting, what were the relative chances for success? Planting was of course tried and proven. Although direct-seeding was comparatively new, it had been tested extensively in Louisiana since 1951. More important, the U. S. Forest Service's Alexandria Research Center had discovered bird repellents for coating seeds in 1953 and had successfully blended bird and rodent repellents in 1956. In the 4 years prior to 1958, about 40,000 acres had been seeded under a wide variety of conditions by 19 different companies in the state. Success had been achieved on better than 95 percent of the acreage, and most of the failures had been due to human errors. With this information plus its own experience, the Company elected to direct-seed and permanently closed its nursery.

The Area

The lands seeded in 1958-1959 are close to Flatwoods, La., a small community about 30 miles west of Alexandria. The entire acreage once had virgin stands of longleaf pine, but by 1958 most of it was treeless. Even scrub hardwoods had been kept out by repeated wildfires.

Native grasses, predominantly slender bluestem (*Andropogon-tener* [Nees] Kunth), formed a dense cover on the ground.

Topography is gently rolling to rolling, but poorly drained flats up to 15 or 20 acres in size occur between hills and on ridge tops. Several large creeks provide major drainage, and intermittent streams are numerous. Hardwoods and brush are dense in the bottoms and along the lower banks of streams.

Soils range from fairly deep coarse sands to heavy silt loams; most have a semi-impervious claypan from 6 to 18 inches below the surface, resulting in poor internal drainage. In general, the shallow pan makes the soils droughty in summer and wet in winter.

Livestock roam freely under open range law. Cows are most numerous, although sheep, goats, and hogs are locally serious. Most of the area is grazed moderately, and concentrated grazing is usual around small settlements and farms.

Although the tract originally had excellent stands of virgin longleaf pine, it was decided to seed mostly with loblolly. A major factor in this decision was the prevalence of hogs, which grub up seedlings to eat the soft outer part of the roots. Fencing hogs out of an area of this size was deemed impractical. Another reason for choosing loblolly was the expectation of earlier thinnings, for longleaf is characterized by slow juvenile height growth. Four sections with low hog populations were seeded with longleaf to compare growth and yields with those of loblolly. Figure 1 shows the area seeded with each species and the various types of seedbed.

How Seeding Was Done

Loblolly. — Loblolly pine was broadcast on 14,320 acres and furrow-seeded on 1,865 acres.

Most of the broadcast sowing—13,380 acres—was from the air onto disked sites (Fig. 2). With loblolly pine, disking is desirable as insurance against excessive first-year losses to the dense grass that develops on open areas. In years of favorable weather, most seedlings will survive and outgrow competing grasses, but Louisiana summers are generally characterized by high temperatures and droughts that last from 3 to 6 weeks.

For economy, disking was in strips 7½ feet wide and spaced 7½ feet apart. It was done in the summer to obtain a high kill of grasses. The light offset harrows were pulled by John Deere 440 tractors (Fig. 3). Heavy roughs were burned to enable the disks to pulverize the soil adequately. No burns were made where livestock had kept the grass short.

All disked areas were sown with 1 pound (before treatment) of loblolly seed per acre. After being stratified for 45 days in wet peat moss at 34°F. to promote fast germination, the seed was coated with a blend of 15 percent Arasan and 2 percent Endrin-50W for protec-

FIG. 2.—Almost 14,000 acres were disked in strips for loblolly seeding. The strips were readily seen from the air at the time of sowing.

FIG. 3.—Light offset disks were used to prepare strips 7-½ feet wide and 7-½ feet apart.

tion against birds and rodents. The sticker was Dow Latex 512-R mixed in the ratio of 1:9 with water. Seed was sown within a few days after the repellents were applied.

The aerial phases began February 16 and ended March 1. A small Bell helicopter and a Piper P18A each did half the acreage (Fig. 4). The Piper sowed about 1,200 acres per 8-hour day, and the helicopter about 3,000. No consistent differences in stocking can be noticed on areas seeded by the two craft, but the helicopter was faster than the fixed-wing plane because it covered a wider swath (90 vs. 66 ft.), lost less time in going to a landing strip to reload, and turned on a shorter radius.

Lobolly was also sown on 940 acres where the recent removal of virgin pine stumps for distillate wood had scarified the soil so thoroughly that disking was unnecessary. Methods and time of sowing were as on the disked strips.

Between March 20 and June 3, about 1,865 acres were sown with tractor-drawn furrow seeders. These machines plowed a furrow, elevated a small ridge in the center of the furrow with two hillers, dropped the seed on the ridge, and pressed it into firm contact with the soil—all in a single operation.

Furrows were about 8½ feet apart, center-to-center. Seeds were dropped 12 inches apart—a sowing rate of ⅓ pound per acre. Stratification and repellent coatings were the same as for broadcast sowing.

All loblolly seed had been collected in 1957 in Mississippi and Louisiana and held in cold storage for 1 year. The various lots averaged 15,500 full seeds per pound. Ninety-six percent of the sound seeds were viable.

Longleaf.—Longleaf pine was sown in early December on 2,360 acres relatively free of livestock. About 1,720 were burned immediately before seeding because the grass rough was so heavy that it would have prevented seeds from reaching mineral soil. On the remaining 640 acres the grass was too thin to require burning. Mechanical site preparation was not required, for longleaf can compete with native grasses on most soils.

As longleaf germinates promptly, stratification was unnecessary. The seed was coated with the same repellent as loblolly, and sown at the rate of 3 pounds (before coating) per acre with the P18A Piper.

The longleaf seed had been collected in Georgia in the fall of 1957 and held in cold storage until sown. It averaged 4,100 sound seeds per pound, with a gross germination of 72 percent.

Inventories

Seedlings were counted in June or July of 1959, and in January 1960. Both inventories were on the same sample plots. Survival in January usually indicates over-all success, because natural mortality after the first year rarely exceeds 5 percent. June counts are useful in appraising the distribution of seed, the effectiveness of repellents, and the extent of field germination, but they come before the fateful first summer when seedlings are most vulnerable to drought.

On broadcast areas all seedlings were counted on mechanically spaced, circular milacre plots. On disked areas, sample plots fell on disked strips and nondisked balks at random, as survivals on both kinds of sites were about equal. Sixteen milacres were sampled on each full section and 12 on portions of a section. Compartment 141 was an exception, because it was the only one sown with longleaf on an old grass rough. Here 48 milacres were used to compare stocking on burned and unburned areas.

On furrowed areas, 15-foot segments of seeded strips were examined. Spaced 10 by 10 chains apart, they totalled 32 per section.

While the intensity of sampling was insufficient for a close estimate of stocking by individual compartments, it was adequate for an appraisal by species and method of seeding.

Stocking

Loblolly—broadcast sown.—Abundant rain and relatively low temperatures made the spring of 1959 far better than average for a seeding endeavor. Initial stocking of loblolly pine was satisfactory on all compartments, ranging from 2,700 to 10,700 seedlings per acre

FIG. 4.—The helicopter sowed 3,000 acres in a single day.

(Table 1). The over-all average was 5,347. The wide range was due primarily to site differences. On the dry, sandy ridges and in the poorly drained flats silting and flooding killed much of the seed. Nevertheless, slightly more than 11,000 acres had a June catch of at least 4,000 seedlings per acre. Though it may seem high, an initial catch of this magnitude is considered desirable for consistent success because summer mortality may reach 80 percent in a dry year.

Distribution of seedlings was also highly satisfactory, for milacre stocking averaged 87 percent. It was less than 75 percent on one compartment (No. 81) of 600 acres, but the 69 percent stocking here was tolerable.

Mortality from all causes between June and January was 16 percent. Summer rains were ample and well distributed, and most of the losses were from livestock. Close to small settlements, where livestock concentrated, mortality on a few compartments reached 40 percent.

The average stand at the end of the first year was 4,451 seedlings per acre, with 83 percent milacre stocking. The lowest catch was in compartment 37, which had 1,600 seedlings per acre and 73 percent of the milacres stocked—more than adequate for a stand. It appears, then, that the entire 14,320 acres of broadcast seeding was successful. In this year, disking had been an unnecessary expense.

TABLE 1.—INITIAL AND FIRST-YEAR STOCKING PER ACRE OF LOBLOLLY PINE SOWN FROM THE AIR, BY COMPARTMENTS

Compartment[1]	Area sown	June stocking		January stocking	
		Seedlings	Milacres	Seedlings	Milacres
	Acres	*Number*	*Percent*	*Number*	*Percent*
36	160	3,100	83	2,000	80
37*	632	3,100	80	1,600	73
38*	470	4,800	100	3,750	92
41	290	5,000	82	4,540	82
42	170	7,800	100	6,930	100
43*	170	2,900	78	2,550	67
56*	643	4,800	88	3,940	81
57	420	6,600	83	5,420	75
59	639	4,300	100	2,810	94
60	40	[2]	[2]	3,000	75
63*	80	5,440	100	3,120	92
64	564	4,100	81	3,400	75
65	522	4,600	93	4,400	93
66*	642	4,400	78	3,930	71
76	639	3,700	81	3,130	81
77	592	7,100	100	6,660	100
78	500	3,800	75	3,600	75
79	602	5,700	81	4,600	81
81	600	6,100	69	3,940	69
82	470	10,700	86	10,530	86
83	597	7,600	94	6,560	88
84	513	4,700	90	4,300	90
85	528	2,700	80	2,070	73
97	645	5,700	87	5,130	87
98	390	4,600	75	3,300	75
99	560	8,300	87	6,570	80
102	540	6,000	93	4,930	100
111	440	9,300	83	6,750	83
112	624	3,200	88	3,200	81
113	638	5,300	100	4,800	100
Total area	14,320				
Weighted average		5,347	87	4,451	83

[1]All compartments were disked in strips, except that those marked with an asterisk contained some acreage where the removal of stumps had made disking unnecessary.
[2]No data.

TABLE 2.—INITIAL AND FIRST-YEAR STOCKING PER ACRE OF LOBLOLLY SOWN WITH FURROW-SEEDERS, BY COMPARTMENT

Compartment	Area sown	Dates of sowing	July stocking		January stocking	
			Seedlings	Distribution	Seedlings	Distribution
	Acres		*Number*	*Percent*	*Number*	*Percent*
140	635	March 20-April 13	1,435	72	1,368	65
161	490	April 14-May 5	1,265	63	1,053	70
170	150	May 6-May 12	1,139	47	991	47
169	590	May 13-June 3	653	62	784	60
Total area	1,865					
Weighted average			1,119	64	1,070	63

TABLE 3.—INITIAL AND FIRST-YEAR STOCKING PER ACRE OF LONGLEAF PINE, BY COMPARTMENT

Compartment	Area sown	Seedbed	June stocking		January stocking	
			Seedlings	Milacres	Seedlings	Milacres
	Acres		*Number*	*Percent*	*Number*	*Percent*
141	640	Rough	4,200	92	3,940	84
142	440	Fresh burn	3,690	81	3,190	81
143	640	Fresh burn	4,880	88	3,240	82
144	640	Fresh burn	4,650	76	3,940	76
Total area	2,360					
Weighted average			4,411	87	3,610	82

Loblolly—furrow-seeded.—Table 2 gives results of the furrow-seeding of loblolly pine on 1,865 acres. Initial counts were made in July, before germination on late-sown compartments was complete. However, first-year as well as initial stocking varied with date of sowing, and the highest stocking was obtained from the earliest sowing. Sowing in late March and early April (compartment 140) yielded slightly over twice as many seedlings as sowing in late May (compartment 169).

While stocking and distribution in compartment 169 are barely at an acceptable minimum, the furrow-seeding in general must be judged successful. The stand is thinner than on broadcast areas mainly because only ⅓ as much seed was used. Late sowing also lowered the catches. In Louisiana, loblolly should be sown in February to have the best chance for getting ample moisture during germination and for producing large seedlings before the onset of hot, dry weather. The unusual cool, rainy weather in late spring and early summer accounted for the success of the sowings.

Longleaf.—All of the longleaf seeding was highly successful, averaging 4,060 seedlings per acre and 87 percent milacre stocking in June (Table 3). Variation by compartments was small. The rough appeared to be as good a seedbed as a fresh burn.

Mortality in the first summer averaged 11 percent, and did not exceed 20 percent in any compartment. Stocking in January ranged from 3,190 to 3,940 seedlings per acre with an over-all average of 3,610. Milacre stocking averaged an excellent 82 percent.

Costs

All cost data given here are averages from typical commercial direct-seeding operations on sites comparable to those of T. L. James & Company. They thus avoid both unusually low and high expenses which might result from unique economies or unavoidable circumstances. Stumping operations before seeding saved considerable expense, for example, and the magnitude of the undertaking made pos-

sible other economies in the cost of seed, airplane hire, etc.

From average costs of many commercial seeding operations, it can be assumed that the entire job on 18,545 acres cost $100,842 or $5.44 per acre. Loblolly cost $5.80 per acre to seed on disked strips, $3.80 on stumped land with no disking, and $3.17 on furrow-seeded areas. Longleaf seeding cost $5.84 on burned areas and $5.78 on unburned. A detailed summary of average costs per acre by species is given below:

Loblolly—broadcast	
Burning (⅛ of area burned at a cost of $0.06 per acre)	$0.02
Disking (cost $2.00 per acre, except 940 acres stumped and not disked)	1.87
Seed (1 pound per acre)	3.00
Stratification of seed	.02
Repellents (materials and labor)	.26
Airplane costs and flagging	.50
Total	$5.67
Loblolly—furrow-seeding	
Burning	$0.06
Furrowing and sowing	2.00
Seed (½ pound per acre)	1.00
Stratification	.02
Repellents	.09
Total	$3.17
Longleaf	
Burning (⅔ of area burned at a cost of $0.06 per acre)	$0.04
Seed (3 pounds per acre)	4.50
Sowing	.40
Repellents	.78
Flagging	.10
Total	$5.82

Furrow-seeding of loblolly pine was substantially cheaper than broadcast distribution because less seed was used, flying and flagging expenses were eliminated, and it cost no more to operate the seeder than to disk in strips. However, the higher sowing rate in broadcast seeding gave added assurance against adverse weather during the germination period or the summer. With 2 years of experience behind it the Company might logically reduce broadcast sowing rates. The recommendation of 1 pound of loblolly per acre is merely a starting point for adjustments as local experience dictates.

Similarly, longleaf seeding on average sites has been so effective in the last 5 years that current recommendations are to sow 2 pounds per acre on all but adverse sites. Had this reduction been made, the longleaf seeding would have averaged about $4.30 per acre.

The cash outlay would have been slightly less than $23,000 if all equipment had been purchased new. This sum includes 4 John Deere 440 tractors, 4 John Deere WH-75 offset disks, 1 cold-storage room for seed storage and stratification, and 1 small cement mixer to coat seed with repellents. All of this equipment can be used in subsequent seedings, and much of it can be applied to other work.

The capital expense was about 25 percent of that for planting a similar acreage. If it is assumed that a single tractor-planting unit can plant 1 million trees annually, the task of planting 18-½ million seedlings in a single winter would call for 18 units or a total of about $99,000. Added to this would be the cost of several 1-½-ton trucks to bring seedlings from the nursery to the site, haul parts and equipment to repair the planting machines, and carry crews to and from the field.

Conclusions

T. L. James & Company's large and successful project in Louisiana clearly shows that direct-seeding is a valuable reforestation technique for the South. It will not replace tree planting entirely, but it will give landowners greater flexibility and economy in regenerating depleted lands.

Both planting and seeding have certain limitations. On adverse sites where first-year survival may be poor, planting should be relied on exclusively. Conversely, direct-seeding is better adapted to sites with heavy stands of hardwoods or logging debris. Areas like the one discussed in this paper lend themselves either to planting or seeding, and landowners must reach a decision by considering the costs and risks of both methods.

The Company successfully seeded for about half the cost of planting, and with a capital outlay of about 25 percent of that needed for planting. Moreover, the labor force was substantially smaller, and training and supervisory problems simpler. The risks were about the same, for direct-seeding is reliable if recommended procedures are carefully followed.

While this seeding project has set a record for size, the new mark may be short-lived. As this article is being written, T. L. James & Company is in the middle of a new project of 45,000 acres.

Knowles A. Ryerson Named to South Pacific Commission

Knowles A. Ryerson of Berkeley, Calif., dean of the University of California College of Agriculture, was reappointed December 12, 1960, by President Eisenhower as senior U. S. commissioner on the South Pacific Commission.

The appointment is for a two-year term. Dean Ryerson has been on the Commission since 1953.

It is composed of representatives of six nations in the South Pacific region and of nations having interests there. Its purpose is to advance the economic welfare of the area.

An internationally known horticulturist, Dean Ryerson is an Associate Member of the SAF.

Similarities Among Owners of Small Private Forest Properties in Nine Eastern Localities

T. A. McClay

THE POTENTIAL contribution which small private forest ownerships can make to the nation's forest economy has been shown in a comprehensive appraisal of our timber resources by the U. S. Forest Service.[1] Since these ownerships occupy about half of the total commercial forest area in the nation, they cannot be ignored. The fact that there are some 4½ million owners involved points out that real improvements in forest productivity will not be achieved without considerable effort. Knowledge and understanding of the existing situation are required if this effort is to be effective.

THE AUTHOR is with the Division of Forest Economics Research, Forest Service, U. S. Dept. Agric., Washington, D. C.

[1]U. S. Dept. Agric., Forest Service. Timber resources for America's future. U. S. Dept. Agric., Forest Resource Report 14. 713 pp. Illus. 1958.

A number of localized studies of small private forest ownerships have been made over the years. In addition to these research efforts numerous articles have been written expressing viewpoints, policies, or recommendations for getting improved forest practices on these small ownerships. Much of the literature has been descriptive in nature, dealing to only a limited degree with owner characteristics and attitudes. Thus, we still know comparatively little about the feelings of these owners toward growing timber on their land and, of even greater importance, why they feel as they do. The success or failure of efforts to increase productivity on small forest ownerships depends to a large extent on understanding the attitudes and motivations of landowners.

During 1958, the five eastern forest experiment stations of the Forest Service[2] completed a series of exploratory studies aimed at expanding knowledge of the characteristics, attitudes and motivations of those who own and control private forest properties of less than 5,000 acres. There were nine study areas, each consisting of one or more counties, located in the States of New York, Pennsylvania, Wisconsin, Kentucky, Ohio, Missouri, North Carolina, Georgia, and Arkansas. A total of 957 owners were interviewed; sample size ranged from 71 in Kentucky to 180 in Wisconsin (Table 1).

The objectives of these studies were to determine the characteristics of owners of small forest properties; attitudes toward their

[2]The forest experiment stations and their locations are: Southern, New Orleans, La.; Southeastern, Asheville, N. C.; Northeastern, Upper Darby, Pa.; Lake States, St. Paul, Minn.; and Central States, Columbus, Ohio.

TABLE 1.—SOME CHARACTERISTICS AND ATTITUDES OF OWNERS OF SMALL PRIVATE FOREST PROPERTIES IN NINE AREAS OF THE EASTERN UNITED STATES—1958

Item	N. Y.-Penn.	Central Wis.	Elliot Co., Ky	Ross & Vinton Cos., Ohio	Union & Hardin Cos., Ohio	Wayne Co. Missouri	South Central N. Car.	South Georgia	S.W. Ark.
				Percent of Owners					
Ownership held by individual	94	100	91	88	95	78	71	81	74
Major occupation—farmer	43	52	84	20	64	28	39	39	38
Acquisition by purchase	77	83	74	61	65	82	65	67	59
Residence within 25 miles of forest tract	97	90	94	78	96	63	95	99	80
Owners over 50 years of age	48	53	46	57	75	73	58	54	54
Tenure more than 20 years	32	24	24	33	32	27	30	37	33
Used some forestry practice	36	33	34	38	19	9	30	35	10
Believed forestry practices profitable	32	60[1]	31	37	20[1]	39	48	53	56
Used services of professional forester	17	9	17	14	6	10	15	22	12
Obtained ACP forestry payments	7	9	20	0	0	0	5	6	6
Planted forest trees	28	29	14	17	8	2	19	15	8
Sought credit with forest land or timber as security	0	2	0	1	0	2	0	0	8
Sought insurance against forest fire	0	1	0	3	0	1	0	0	1
Placed forest land under lease or similar arrangement for forest management purposes	0	0	0	0	0	8	0	0	1
Taxes on forest land and timber affected forest management decisions	3	8[1]	7	4	20[1]	4	3	3	3

[1]Unreliable—based on partial sample of respondents.

forest lands and toward various public and private programs to improve forestry practices on private land; and reasons why these landowners adopted or did not adopt specific forestry practices. Each study aimed to explore the problem according to the particular conditions within its territory as a basis for more intensive research relating to owners and to forestry programs. Detailed analyses of local conditions, influences, and results are being published separately by each forest experiment station.

The attitudes of owners toward their forest land are necessarily shaped by the conditions which exist in their region. Forest type and growth potential, timber supply and product demand, forestry assistance offered, or nonforestry income opportunities, for example, may exert considerable influence. Such factors may even produce differing attitudes between local areas within a broad region.

The localities in which the studies were made differed in many important respects. Although most areas were essentially rural, one was of an urban, industrial character. The economy of another was overwhelmingly based on farm crops and livestock with forest products contributing only 0.1 percent of all farm products sold. In some areas forest products markets were easily available while in others they were inadequate. Other factors such as average size of ownership, length of tenure, forest type and condition, growth potential, etc., differed among localities.

The individual owner is the decision-maker and how he thinks and reacts has an important bearing on progress toward forest improvement on small private ownerships. Therefore, similarities of owner response that appear in spite of diverse influences in these nine widely-separated localities will provide useful information.

The following generalizations provide a composite picture of certain characteristics and attitudes of forest landowners interviewed throughout the eastern United States. More complete information on any single factor such as the relation between ACP payments and forest improvement, for example, group arrangements for forest management purposes, effectiveness of insurance and credit facilities, availability or use of forestry practices and services, etc., presumably can best be determined by further research concentrated on the particular factor.

Individual Ownership Most Common

Nine out of ten owners indicated that legal ownership was held by an individual. The percentage was smallest among those interviewed in the South but even here it averaged some 75 percent. The balance of ownerships were held either as partnerships, corporations, or estates with no clear majority evident among them. Although the latter categories held a slightly higher percent of the total acreage than their proportion of numbers, the key to increased timber production from small forest tracts is held by the great mass of individual landowners.

Farmers Represent Largest Occupational Class

Although farmers were more numerous than other occupational classes there was not always a clear-cut majority and a considerable number of owners classified themselves as business-professional or wage earner-clerical. In all, some two-thirds of the 957 owners contacted were in the foregoing groups. The balance were largely housewives, widows, retired persons, or operators of wood-using plants.

The Wisconsin study indicated that the owner group classifying themselves as farmers often gave answers different from those given by nonfarmers. Therefore occupation may be a useful measure of owner attitude in some cases. However, in other areas owner occupation could not always be clearly defined. For example, some ownerships had more than one owner or some owners had more than one occupation. Many owners occupying farm properties consider themselves farmers yet gain their principal livelihood from other occupations. Perhaps a classification such as size of holding or total annual income in conjunction with two or three easily-defined occupational classes may prove to be more valuable than occupational class alone as sought in these exploratory studies.

Most Owners Hold Less Than 100 Acres of Forest Land

In practically every study area the largest group of owners were those holding less than 100 acres of forest land. They comprised two-thirds or more of all owners in eight of the nine localities and averaged about 85 percent of the total. However, the acreage which this group controls is not commensurate with their numbers, averaging about 45 percent of all forest acres. Contacting these individual owners to convince and assist them to increase timber yields on their properties is a formidable task because of their large numbers.

Owners with more than 100 and less than 500 acres were the next largest group, making up some 15 percent of all owners. Because of their larger average holding they represented about 35 percent of the total acreage. Each owner in this size group who can be "sold" on forestry represents four times the acreage of an owner holding less than 100 acres. Therefore, effort expended in developing going forestry businesses may be more promising here than with the very small owners.

Only one locality showed more than a few percent of the owners with holdings between 500 and 5,000 acres. It is to be expected that the aggregate acreage of these larger ownerships would be more than their numbers indicate; it averaged from about 20 percent in the southern study areas to 10 percent in the northern areas. Most owners in this size class understand the desirability of increasing the productivity of their forest lands and seek assistance to achieve this goal.

Purchase Most Common Form of Forest Land Acquisition

Two-thirds of the owners acquired their timberlands by pur-

chase and most of the others obtained them through inheritance. A very few owned forest land as a result of a gift, foreclosure, or other reasons. Whatever the means of acquisition, forest lands were usually obtained as part of a deal involving other lands valued for pasture or annual crops. Except where timber speculation was being considered, nonindustrial owners seldom looked upon forest land as a separate entity with a sustained income-producing capacity. Therefore, the method of acquisition is not likely to be as important as the reason for acquisition. Progress toward recognition of forest values will have been made when forest land is no longer a mere appendage to over-all land sales.

Considerable Variation in Length of Tenure

The number of years forest land has remained in present ownerships varied over a wide range. About a third of the owners had held the land less than 10 years; a third from 10 to 20 years; and a third for more than 20 years. This general pattern occurred in each of the nine study areas. It is encouraging that one-third of the forest properties remained under one owner's control for 20 years or more. Forest values resulting from planting or stand improvement would be evident in this length of time. Although long-term ownership is not essential to maintaining forest productivity, it does bring a stability of intent that may be lacking under shifting ownership.

Majority of Owners Reside Near Their Forest Tracts

In each study area at least two-thirds of the owners had residence within 25 miles of their forests and in most areas 90 percent or more lived within this distance. A high proportion of owners—50 to 75 percent—lived on their forest property. Thus, a large number of owners would probably not consider travel costs a deterrent to management and inspection of their woods. The real problem, of course, is to convince an owner of timber-growing opportunities and motivate him to take action. In most areas absentee ownership should not be too serious an obstacle toward achieving this goal.

Few Owners Could Expect to Plant and Harvest a Pulpwood Crop

Over half of the owners interviewed were over 50 years of age and about one-third were 60 years or older. Except on the better pine sites in the South, few of these owners have a life expectancy which would exceed a pulpwood rotation. Even though almost half the owners are under 50 years of age, a large number of these could not expect to harvest the trees they planted. The financial incentive to plant, then, must come from an expected higher sales or estate value for land with an established stand as compared to land with a severely understocked or non-existent stand. This valuation principle has long been accepted in other fields and is becoming more commonly recognized in forest land transactions.

There may also be important nonfinancial incentives to plant. Some owners, regardless of age, might be motivated by social or moral considerations. Confidence that control of the land will remain in the family after the present owner's death could also favorably influence forest practice actions.

Ratio of Forest Land to Total Land Ownership Highest Among Large Ownerships

All localities showed a steady increase in the ratio of forest land to total land ownership with increasing forest ownership size class. Although these ratios varied a little between study areas, they averaged about 25 percent in the size class under 30 acres, 45 percent in the 30-99 acre class, 60 percent in the 100-499 acre class, and 90 percent or more in forest ownership size classes over 500 acres. Thus an owner with 20 acres of forest land would also hold some 60 acres of nonforest land and one with 1,000 acres of forest land averaged about 100 acres of nonforest land ownership. This relationship indicates that those owning smaller tracts probably obtain a higher proportion of their gross income from nonforest lands than do those with larger forest tracts. A reasonable assumption, therefore, is that owners of smaller tracts might be less inclined to invest time and money on their forest land.

Timber-Growing Major Intent of Forest Land Use in Most Localities

In all but two study areas a majority of owners claimed timber-growing as the intended use for their forest land; in northwestern Ohio grazing was considered a greater use, and in Missouri most owners indicated nonincome producing uses. However, interviewers felt that the term "timber-growing" was not properly understood by owners as a deliberate activity. No doubt many who professed such a use were doing nothing to their woods. Some owners have little or no conception of tree growth; others realize that timber volumes increase annually but maintain a passive attitude; and some fully understand that this growth can be manipulated by conscious management to bring optimum returns. In spite of some uncertainty as to real intent, it is encouraging that a majority of owners consider timber-growing an important forest land use.

Grazing, residence, recreation, or indefinite use were of relatively minor importance in most localities. A very small percentage professed speculation as the intended use and practically none reported holding land because it gave them a feeling of security or simply for the satisfaction of owning land. The locality in which grazing was the most important use also had the highest percentage of owners who intended to convert their land for agricultural use. In most localities intended use was strongly influenced by prevailing conditions such as lack of markets for timber products, deteriorated stands, low-production sites, or a competing livestock industry.

Forestry Practices Not Being Used by Majority of Owners

Even though a majority of owners claimed timber-growing as the intended use of their forest land, only about a third had carried out

any type of forestry practice; in Missouri and even in Arkansas only 10 percent had done so. Planting was the most widely-used forestry practice and much of this was done on old fields rather than in cutover or understocked stands. Less than an average 15 percent of all owners had ever used any other forestry practice such as stand improvement, regeneration cutting, plowing fire lanes, fencing out stock, etc. This strengthens the belief that many owners do not fully appreciate what timber-growing involves or lack resources for more than negligible management. As size of ownership increased, use of forestry practices increased in all localities. Thus, the relationship indicated below between ownership size and belief in the profitability of forestry practices is confirmed by positive action in the woods.

Size of Ownership Correlated with Belief That Investments in Forestry Practices Profitable

In most localities there was a general tendency for belief in the profitability of forestry practices to increase with increasing size of forest holdings. This ties in with a similar increase in the ratio of forest land to total land ownership already noted and the observation that owners of large tracts would have greater interest in their forest land. The percent of owners indicating a belief in the profitability of forestry practices was not uniform by size class from one locality to another. However, a positive attitude was more evident in the South where 50 percent or more of all owners were so inclined compared to a third or less in other study areas.

In most localities the percentage of owners who believed forestry practices would be profitable was larger than the percentage who had taken action. A favorable environment may thus exist for motivating additional owners to apply forestry practices on their properties.

Few Owners Made Use of Professional Services

Of all owners interviewed only about 15 percent had used professional forestry services on their properties; the range was from 6 percent in Ohio to 22 percent in Georgia. In general, the percentage of owners holding more than 100 acres who used these services was double that of owners holding less than 100 acres.

The most important single reason given for not using a forester was that the owner was not interested—from about 25 percent in the South to 40 and 50 percent in most other localities. The underlying reasons for lack of interest were not determined in these studies; future studies should do this since it may uncover valuable leads for owner motivation. A smaller number stated they were either unaware services were available, or that they themselves had sufficient knowledge of forestry. Many owners gave miscellaneous reasons which could not be classified. The fact that some 60 percent of owners in the South and 30-40 percent in most other localities gave unclassified reasons indicates the wide variety of motivations which may influence forest landowners' attitudes toward forestry.

Those owners who did use professional forestry services were asked whether they were influenced to do so by foresters, private individuals, nonforester public employees, demonstrations or meetings, or forestry literature. What source originally motivated an owner to use these services could not be determined. It is probable that most owners gave a reply based on their latest contact. According to the replies, each of these media, with the exception of forestry literature, had a major influence in one or more localities on those owners who had used professional forestry services. This brings out the importance of personal contact. Literature alone may not be enough to interest owners in practicing forestry, but should be used and interpreted by qualified individuals on the ground.

Owners Fail to Take Advantage of Forestry Payments Under ACP

Judging from the handful of owners who sought financial assistance under the Agricultural Conservation Program, most owners either lack enthusiasm for growing forest crops or have not been sufficiently informed about incentive payments. Not more than 10 percent of the owners in any locality except Kentucky (20 percent) had ever obtained ACP payments. The reasons given, in descending order of importance, for not having done so were: not interested in forestry, unaware the payments were available, lack of time to do the work required, unsympathetic to program, and too much "red tape" involved in making application. These major reasons combined to make up 60 to 90 percent of the replies; the balance of the replies consisted of numerous reasons which could not be included with those above.

Planting Most Widely Used Forest Practice

About 50 percent of the owners who had used some forestry practice on their land had done planting. Although the differences were not large, the percentage was higher in the North and South than in the Central States. Public nurseries were the major source of planting stock in all localities and the most important media influencing owners to plant were nonforester public employees such as county agents. Since these preliminary studies did not measure the relative activity of the various influencing factors in each locality, results obtained may merely reflect the greater presence of such factors.

Seventy-five percent or more of all owners had never planted trees on their forest lands. The major reason given for not having done so was lack of what they considered a plantable area. However, less than half of the owners gave this reason and many of these owners may not fully understand where and when planting is desirable. Lack of time was also an important reason. A smaller percentage said they were unaware that assistance was available. Less than 5 percent of all owners said they were unsympathetic to public aid planting programs or that the terms of the programs were unsatisfactory.

Taxes Had Little Effect on Management Decisions

In no locality was there more than 10 percent, and in most localities less than 5 percent, of the owners who considered land and timber taxes to have any effect on their forest management decisions. The total annual tax which most owners of small forest properties pay on their forest land and timber is no doubt small, particularly in relation to tax charges on other land. However forest land is often not separately assessed and many of these owners have incomplete knowledge of just what they are paying.

There is also a well-defined trend for tax rates to rise; moreover, in some instances, especially where substantial timber values are present, assessments are likely to rise relative to those on other classes of property as assessment methods improve. A higher tax and fuller knowledge of the actual situation might easily change the current attitude of many owners toward forest land and timber taxes.

Although the evidence was not strong there was an indication that taxes affect management decisions to a greater extent where the owner follows forestry practices than where he does not. Similarly, responses showed that owners of the larger forest tracts tended to be more concerned about land and timber taxes than did owners of smaller tracts.

Use of Credit or Insurance on Small Ownerships

Not more than 2 percent of all owners had ever tried to borrow funds on the security of their forest land or timber, or seek insurance against fires and other forest hazards. In Arkansas 8 percent had sought credit; most of these did so for nonforestry purposes. Because many owners placed such a low value on their forest land it had apparently never occurred to them to seek credit or insurance. Few felt a need for credit and what borrowing they did was based on assets other than timber. There were many owners who did not know insurance might be available; even if it was they still were not interested, since they did not consider their forest values high enough to warrant insurance at going rates. No doubt many small forest properties actually do have a low value. In some cases low value may be based upon lack of knowledge or misinformation. Whatever the cause, real or imagined, forest land values will have to be improved before much credit or insurance will be sought under current conditions.

Leasing or Other Arrangements for Forest Management May Hold Promise

Leasing and other similar arrangements refer to placing forest land under the management of some other party. It could range from a loose verbal agreement to a written contract explicitly stating responsibilities. Most owners had never been offered such an arrangement and there were few in existence. An exception was the Missouri Forest Crop Law, a tax relief and management program administered by the Missouri Conservation Commission; 8 percent of the owners interviewed in the Missouri study had their forest land under lease.

When owners were asked if they would consider making some arrangement, 25 percent in the Central States and 10 percent in the other study areas expressed interest. This is not a very large percent. However, leasing or some other group arrangement appears logically to offer a means by which forest improvement could be extended to many small ownerships. Initiation of good forest management on the large number of small forest ownerships presents a tremendous problem when they must be reached as individual units. Agreement to consolidate and turn over management to a skilled and responsible agent may be a long step in the right direction.

Summary and Conclusions

The knowledge gained from interviewing 957 owners of forest tracts under 5,000 acres at nine widely separated localities in the eastern United States confirms much of what is already known of their characteristics and attitudes.

The majority are farmers holding the land as individuals; own less than 100 acres; have acquired the property by purchase; are over 50 years of age; live within a reasonable distance of their forest property; and show a considerable variation in length of tenure.

A minority apply forestry practices on their tracts or make use of the services of professional foresters. A very small percentage have obtained ACP payments, sought credit or insurance, leased their forest land for management purposes, or consider forest land and timber taxes a deterrent.

It was also noted that the percentage of owners holding a favorable attitude toward forestry definitely increased with increasing size of forest land ownership.

These exploratory studies made some progress toward learning why owners of small forest properties feel as they do regarding the adoption of forestry practices or participation in assistance programs. Thus, when owners were asked why they had not adopted practices or utilized assistance the answer most frequently given was that they were not interested in forestry. Such response points out that future studies should place greater emphasis on the motivational aspects which underlie forest landowners' action or inaction. Anyone familiar with the small forest landownership situation will vouch that interest in forestry is increasing each year. It is also evident that much remains yet to be done if the full potential of these forest lands is to be realized.

Risk Rating For Fire Prevention Planning

Craig C. Chandler

"BECAUSE of the complexity of prevention problems and the diversity of forms of prevention work, it is easy to fall into confusion and poor use of time. Selectivity and economy of effort are indispensable, both in the study of problems and in planning for action. Mere quantity of effort expended in prevention means nothing unless the effort is directed by research which uncovers the key points at which effort may be employed most effectively" (*5*).

This challenge to research, issued by the acting chief of the Forest Service more than 20 years ago, applies with even greater urgency today. Rapidly expanding populations, particularly in the West, are causing an impact on our forest areas undreamed of even a decade ago. Furthermore, new advances in technology and a growing urbanization of areas in and next to forested lands are presenting fire prevention workers with fresh problems whose existence was not even recognized when the last U. S. Forest Service fire planning studies were made. To keep from being completely overwhelmed by this pyramiding prevention job, and to uncover the key points at which effort may be employed most effectively, it is necessary to develop some means of rating the relative risk of the various fire-causing agents that make up the total prevention load. As part of the intensive fire planning job undertaken by the California Region of the Forest Service, the Pacific Southwest Forest and Range Experiment Station has developed a new system of risk rating designed to compare areas with radically different prevention problems. The complete data and results of this system will be published by the region in conjunction with the fire planning synopsis. However, the philosophy behind this new method of risk rating, as well as the general methods used and a discussion of the problems encountered may be of interest to research workers and fire planners in other areas.

In theory, the number of accidental, man-caused fires occurring on any area can be predicted from a knowledge of only four factors:

1. Weather—expressed as the relative ease with which a standard fuel will ignite as a result of variations in all weather factors.
2. Fuels—expressed as the relative ignitability of fuel types under a standard set of weather conditions.
3. Risk—the chance of a fire starting as determined by the presence and activity of causative agents.
4. Prevention effectiveness (as distinct from prevention effort).

To develop a risk rating, we need only inventory the kind, number, and activity of causative agents, plug in the other variables required, and determine the risk (relative chance of a fire starting) for each type of cause. Simple enough, in theory.

In practice, though, developing a risk rating is a complex business. To begin with, the four factors are not independent. For example, the presence and activity of forest users on a particular area varies directly with weather conditions. Fuel types are also directly related to weather. Certain risks such as logging are found only in certain fuel types. In addition, some factors cannot be measured directly, but must be inferred from items that can be inventoried. For example, no fuel-type maps based on ignitability exist, so rate-of-spread types are used as a substitute. We know that rate-of-spread is closely correlated with ignitability, but we also know that the relationship is not exact. Lastly, inventories of items that are directly measurable and can be used to develop a risk rating are rarely available in published form. Considering each of the factors required in turn:

Number of Accidental Man-Caused Fires

Although complete and detailed statistics on fire causes are available for nearly all areas under organized protection, the summarized, published data are unsuitable for developing risk ratings. Data from most agencies include all fires which burned over a protected area, regardless of whether or not the fire started on an area of prevention responsibility. These fires should be excluded from the rating base.

Fires should be segregated by causes directly related to specific prevention measures. This is not done in the standard fire cause classification. For example, a fire started by sparks from a diesel locomotive is classed as a logging fire if the engine happens to be working on a logging operation, but as a railroad fire if the engine is on a common carrier line. From a prevention standpoint these two fires should have identical classifications.

Some standard classifications, particularly smoker, are notoriously weak statistically (*2*). That is, the probability that a fire classed as smoker was actually started by someone's careless smoking habits is much less than the probability for other fire-cause classifications.

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If a risk rating is to have widespread application, all the classifications used should have an approximately equal degree of validity.

Finally, it must be remembered that fire-cause classifications are to be correlated with measures of forest use associated with the specific cause. For some of the standard classifications, it may be difficult or impossible to measure the associated use. For instance, it would be hard to arrive at a reasonably exact figure on the number of debris burners on an area or the total man-days spent in debris burning.

For purposes of risk rating, a special classification of fire causes must be established and each individual fire report must be examined and classified. The classifications selected will vary because of differences in prevention problems between areas. The following fire cause breakdown was used in developing the risk rating for the California Region and has proved satisfactory:

Power line	Resident
Railroad	Hunter
Logging	Camper
Other industrial	Fisherman
Roadside	Picnicker
Nonpreventable	

Although these categories do not always follow the same definition as the standard classification system, only two of them are completely new. Roadside fires were defined as fires which would not have started had the right-of-way been fireproofed for 50 feet on either side. Fires were classed as nonpreventable if no reasonable prevention action was possible at the local level. Aircraft crashes and spontaneous combustion outside of dumps or buildings are good examples.

Weather

Fire incidence is definitely correlated with weather changes, and the number of fires occurring on a given area can be predicted from weather factors alone if risk remains constant (*4*). The ideal method of measuring weather variables for use in a risk rating is through an ignition index designed specifically for that purpose. However, fire danger rating systems based on rate of spread may be used as acceptable, though imperfect, substitutes (*3*).

One practical difficulty in obtaining an adequate weather index for use in risk rating is in compensating for variations in the length of the fire season between rating areas. In locations where fire danger records are kept yearlong, this problem is easily handled by totaling the daily records. But when records are available for certain months only, some method must be devised to cover the full period of fire occurrence. In developing the California Region risk rating system, a "length of season" was arbitrarily described as the consecutive number of days within which 90 percent of all fires occur. The annual weather index was then defined as the average daily burning index multiplied by the length of season. This index has not proven completely satisfactory and will be replaced with a true ignition index as soon as possible.

Fuels

Ideally, an index of fuels to be used in risk rating should be based on the relative ignitability of standard fuel types under specified weather conditions. Although no such fuel classifications have ever been devised, fuel maps based on rate of spread criteria such as Hornby's (*7*) or on flammability zones (*1*) can be used without serious error. It should be noted that a fuel index based on analysis of fire incidence by fuel types can *not* validly be used in preparing a risk rating system. When such an index was devised for California by determining the average number of fire starts per acre by fuel types, serious anomalies were immediately evident. Further investigation disclosed that forest use also varied markedly by fuel types, that the number of starts represented both inherent flammability differences and differences in risk, and that these effects cannot be separated. Consequently, the California risk rating system uses flammability zones as an indirect measure of fuel ignitability.

The Presence and Activity of Causative Agents

Superficially, this would appear to be the easiest factor to obtain of any of the data needed to develop a risk rating. One would think that any desired statistic would be readily available somewhere in the mass of accumulated data. Unfortunately, however, acceptable data on forest use for each category of fire incidence has proved to be impossible to obtain without time-consuming recompilation or complete reinventorying on the ground. Although all land management agencies spend a good deal of time collecting and compiling information on many subjects, these surveys normally are only fragmentary in nature and not too well related to similar surveys taken within the same agency or by some other agency. Consider logging statistics as a common example. Extremely detailed data on all phases of logging operations are obtained by the Forest Service, by the State of California, and by individual logging operators. But the Forest Service figures are compiled for national forest lands only, the state figures are for individual counties, and the operators keep records by each timber sale, regardless of ownership. Before the data can be used in developing a risk rating, they must be traced back to the original work sheets, plotted on a map of the protection area, and separated by flammability zones through the use of overlays.

To obtain data on nonindustrial use, where accurate statistics are less readily obtainable, it is usually preferable to start from scratch and have field inventories made specifically for risk rating purposes. Although the collection of these data on California national forests required several man months, the increase in accuracy made the effort well worth while.

Another major complication is deciding just what measures of forest use to obtain for correlation with specific categories of fire incidence. As previously mentioned, this problem must be considered when setting up fire classifications, but it is particularly acute when

collecting data on forest use since ground inventories often involve considerable time and expense. To continue the example of logging. The number of logging fires might logically be expected to vary with volume of cut, species, area cutover, number of men in the woods, type of logging methods, or any combination of these factors. It is seldom possible to arrive at a purely rational selection of any single factor to best represent a specific fire cause, and in fact it may be highly undesirable to do so. The accuracy of the statistics on forest use will vary widely, and often the best correlation with fire incidence will be developed from highly accurate data on a type of use that appears to have only an indirect relationship to the number of fires. In California, for example, we found that the number of roadside fires was most closely correlated with the miles of road in each engineering category, regardless of differences in volume of traffic between roads.

The best practice in collecting data for risk rating purposes is to obtain as much varied information as possible during the original inventory. It is much cheaper in the long run to collect information on several items at one time than to repeat an entire survey because one essential item of information was overlooked. At any event, data should always be obtained on both number and activity (man-days or equivalent) of each type of use. Table 1 shows the items inventoried in developing the California system.

Prevention Efficiency

In spite of long and continued efforts, no one yet has devised a single yardstick to measure directly the effectiveness of the many and varied kinds of prevention effort practiced on a single prevention district. We can measure the miles of fireproofed roadside and the number of campers whom a patrolman had contacted, but there is no way to equate the one against the other. Until this is possible, the basic risk-rating equation can be solved only by removing prevention efficiency as a factor in determining fire incidence. Although this cannot actually be done, it is possible to determine fire occurrence, weather, fuels, and forest use over a short time period and to consider prevention efficiency as a constant.

In California, where both prevention and forest use have been increasing geometrically, one year was the time period considered. In areas of greater stability, a longer time period and hence a broader statistical base, could be used. Under these conditions we can compare the relative risk of various types of forest use under the prevailing level of prevention effort. The comparison will be valid unless prevention efficiency is directly correlated with weather, fuels, or use. This later hypothesis can be tested statistically; in California there was no such correlation.

Once all the necessary data on fire incidence, fuels, weather, and forest use have been compiled, the development of a risk rating becomes merely mechanical. For each area, fire incidence is corrected for weather and fuels, and regression equations are obtained between the resultant values and the various combinations of forest use. This work can be done most rapidly by high speed computors, but if computor services are unavailable, rank order correlation (*9*) can be used for rapid initial selection of variables. Using the regressions with the highest correlation coefficients, it is possible to compare the risk of fires from any particular type and level of forest use against any other use, or to compare the total risk between areas with unlike uses.

Two words of caution are necessary regarding procedures. First, regressions must be determined separately for each category of fire incidence. Certain kinds of forest use are highly correlated with fuels and weather, and when all uses are lumped, these intercorrelations get buried, and the multiple regressions obtained have limited applicability and often contain nonsense answers.

Second, testing must not be limited to linear regressions. It has become standard practice to show that the amount of forest use has increased faster than the number of fires and to attribute the difference to active fire prevention (*6*). But there is every reason to expect that the number of fires will not vary linearly with forest use regardless of fire prevention activities.

Perhaps this relationship between number of fires and amount of use can best be illustrated by use of an example: If two hunters are camped within sight of each other, each tends to be more careful in his camping habits than he would be if unobserved. Further, there is a better chance that an incipient fire

TABLE 1.—DATA ON FOREST USE COLLECTED FOR RISK INVENTORY[1]

1. Power lines (miles of line)
   a. Over 15,000 KV
   b. 15,000 KV and under
2. Railroads
   a. Miles of track
   b. Train miles per day
   c. Ton miles per day
3. Logging
   a. Volume cut annually by species
   b. Area cutover annually by species
   c. Number of operators
      (1) Under 5MM bd. ft. annual cut
      (2) 5MM and over
   d. Number of sawmills
4. Other industrial activity (list and describe)
5. Roads (miles of road and man-days of travel by standard engineering categories)
6. Residents (residences and population)
   a. Residences
   b. Ranches
7. Recreationists (visitors and man-days of visits)
   a. Hunters
   b. Fishermen
   c. Picnickers
   d. Campers
      (1) Improved campgrounds
      (2) Unimproved campgrounds

[1]All data collected separately by flammability zones.

starting in either camp will be discovered and extinguished by one of the men themselves. Therefore, the number of fires to be expected when the number of hunters increases from 1 to 2 is something less than twice the number to be expected from a single hunter.

Furthermore, there eventually comes a point where increasing the amount of use on an area actually *decreases* the number of fires. In a highly used area such as Yosemite Valley, potential fuels are trampled into the dirt, and it is impossible to drop a match without someone stepping on it. Although Steele (*8*) is probably correct when he says that whenever the number of people increases and the number of fires does not, prevention must be working, this is far from a sure thing, statistically.

Another word of caution is necessary regarding the interpretation and limitations of risk ratings. Although a risk rating gives a true picture of the relative risk between uses or between areas, it is valid only for one particular level of prevention effort. If the level of prevention effort is changed or if emphasis is shifted from one type of risk to another, the ratings will cease to be applicable as soon as the change in emphasis becomes effective. To illustrate, if a particular forest finds that hunters represent three times the risk of loggers, but that prevention effort has been divided equally between the two, the forest may decide to increase the number of hunter patrols at the expense of logging inspections. In this event, assuming that this action is effective, the hunter fire problem will decrease while the logging fire problem gets worse. Until some sound method of predicting effectiveness is devised, risk ratings will always be of transitory value.

Data from the California risk rating will be published in connection with the Regional Fire Planning Synopsis. However, some of the conclusions of this study may be of interest here to illustrate the kind of information obtainable by a risk rating. In the analysis for the California Region of the Forest Service we found:

—That one-quarter of our man-caused fires would not have started if all roadsides had been fireproofed for a distance of 50 feet.

—That hunters caused 3 to 7 times as many fires, man-for-man, as any other group of recreationist.

—That we average only one logging fire for every 30 million board feet cut on national forest land.

—That as many fires are started by powerlines as by picnickers; and that distribution lines, rather than main lines, are the biggest problem.

—That fishermen start more fires than either railroads or incendiarists, and that hunters start more fires than both groups combined.

—That, on one forest with 100 miles of railroad, 43 percent of the railroad fires in the past 10 years have started along a single 5-mile stretch of track.

—That less than 3 percent of our man-caused fires can be classed as nonpreventable.

—That the threat of fires from visitors in regularly maintained, improved camp grounds is negligible. Our problem is the "boondock" camper.

Summary

Risk ratings can be used to focus attention on those jobs where prevention efforts can be most effective. It is important that data be selected with due regard for both accuracy and applicability, that the cause of each fire be analyzed separately, and that the final ratings be recognized as having only local, short-term value.

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A list of the current Section and Division Officers, Committees, and Representatives of the Society of American Foresters appears on pages 161-164, this issue.

Tree Image Recovery on Aerial Photographs as Affected by Printing Method and Film[1]

David W. Myhre and
Merle P. Meyer

IN THE AERIAL photographic industry electronic printers are supplementing or replacing conventional contact printers for more efficient and automatic production of prints and diapositives. Quality improvement and material savings in certain types of mapping photography have been noted, but little information is available on the merits of the printing methods for the interpretation of forest photography. In this study, three interpreters evaluated the methods in terms of tree crown counts on two types of photography.

Printers

The purpose of any photographic printer is to pass light through the negative and activate the photo paper emulsion with the reverse of the negative density pattern. To control the tonal pattern in the final print, it is often necessary to vary the exposing light intensity over certain portions of the negative—a process commonly called dodging.

In the conventional contact printer the source of light is typically a large group of uniformly spaced lights. Manually controlled switches are used to adjust to a certain extent the intensity of the light that will pass through various portions of the negative. Duration of exposure is also manually controlled on most conventional printers.

Electronic printers employ a small moving spot of light produced by a cathode-ray tube (*1, 2*), and thus are capable of dodging much smaller areas more intensively than conventional printers can. The over-all degree of dodge, known as scan, can be preselected (along with exposure time) to produce a print ranging from an exact reversal of the negative with no dodging, to a scan in which existing negative contrast is considerably reduced. In this study, a fairly heavy or "full" scan was employed in order to produce a slightly flat print closely approximating the tone of conventional contact prints.

Study Organization

The study was carried out on the University of Minnesota's Cloquet Experimental Forest, in northeastern Minnesota. The area offered a wide variety of cover types representative of the region and was also covered by good recent aerial photography of two types: (a) panchromatic minus blue and (b) infrared minus blue. Scale was 1/15,840. Both films had been exposed in the summer along identical flight lines within a period of a few minutes. It was thus possible to evaluate the comparative image quality of prints produced on the standard contact printer and an electronic printer at full scan, for two commonly used film-filter combinations.

Ten one-half-acre plots were established in a variety of forest types as depicted on the photographs. To reduce ground count errors due to mislocation, the plots were located with reference to some feature easily identified both on the ground and on all four sets of stereo photographs.

From the photo scale and results of similar studies (*3, 4, 5, 7*) it was anticipated that crown count errors would be large and negative. However, two of the three interpreters counted more crowns on one photo plot than were actually on the ground. This necessitated transforming the mean percent error of tree crown counts into angle (arcsin transformation of percentage) for analysis of variance by the split-plot design (*6*).

Two plot diagrams (*4*) were placed on the photographs and viewed stereoscopically to guide the interpreters while counting. The diagrams were made up as small segmented circles representing one-half acre at 1/15,840 scale, and mounted on thin glass plates (Fig. 1). The orientation of the plates was changed for each count to various azimuths randomly selected from eight choices ranging clockwise from 270° to 90°.

The interpreters counted trees

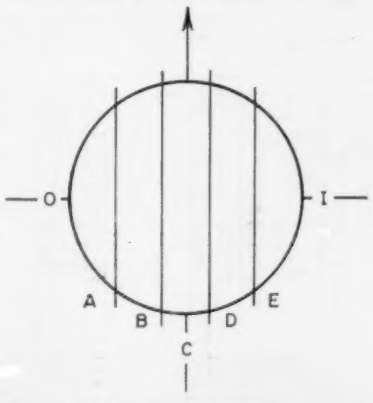

FIG. 1.—Diagram of tree count transparency.

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They are indebted to James Lindquist, of the Universtiy of Minnesota School of Forestry, for assistance in the photo interpretation, and to Mark Hurd Aerial Surveys, Inc., for valuable technical and material assistance.

[1]Based on a portion of a research problem submitted in June, 1958, to the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Forestry; authorized for publication on August 1, 1959, as Sci. Jour. Ser. Paper No. 4203 of the Univ. of Minn. Agric. Expt. Sta.

TABLE 1.—DESCRIPTION OF SAMPLE PLOTS AND PROPORTIONS OF GROUND TREE COUNT RECOVERED FROM ALL PHOTOS

Plot number	Forest type and stand density	Vertically exposed crowns	Tree crown recovery		
			Interpreter A	Interpreter B	Interpreter C
		Number		*Percent*	
1	Pine poles, well stocked	295	40	33	46
2	Upland hardwood poles, well stocked	311	36	36	48
3	Spruce-fir poles, medium stocked	239	36	38	50
4	Pine sawtimber medium stocked	53	85	100	148
5	Pine poles, well stocked	345	40	34	48
6	Lowland hardwood poles, medium stocked	174	54	53	69
7	Pine seedling-sapling, medium stocked	249	20	16	29
8	Upland hardwood poles, well stocked	334	33	31	42
9	Spruce poles, well stocked	265	33	42	56
10	Spruce poles, well stocked	331	33	35	43

in the five segments on the plot diagrams separately and recorded the count for each segment individually on the tally sheet. They were not permitted to total the segment counts for individual plots until all the interpretation was completed.

The second portion of the test was a subjective evaluation of the four types of photography by the interpreters according to the following criteria:

General over-all photo quality.
Preference when counting conifers.
Preference when counting hardwoods.
Relative lack of eye strain.

After the interpretation was completed, the plots were visited to determine the exact number of vertically exposed crowns, species composition, and stand-size classes. This inspection showed that selection of plots in the office had provided a good cross section of forests in northeast Minnesota. Table 1 briefly describes the sample plots.

Results of Interpretation

Differences in photo and field measurements were subjected to analysis of variance comparing interpreters, plots, printing, and film-filter, as well as the interaction between plots, printing, and film-filter. Results of the analysis are given in Table 2.

Variation due to method of printing was not significant (Fig. 2), and the small difference in mean error between the two printing methods would have no practical effect.

A highly significant difference, independent of the printing method, existed between the two film-filter combinations. The panchromatic photography appeared to be superior or equal to the infrared for all plots except one. However, the difference between the two types of photography was quite variable on each plot (Fig. 3). With this small sample, species or size-class combinations did not produce a discernible trend in count success.

The difference between the film-filter combinations is important not only statistically but also for practical purposes. If total mean recovery (in terms of crown count) on panchromatic film were taken as 100 percent, total mean recovery by the infrared photography would be about 73 percent.

The over-counts on panchromatic photography by two interpreters resulted in the indication that infrared photography was superior on plot 4. The over-counts may be attributed to the generally higher image quality of the panchromatic photography used in the test. On the panchromatic prints interpreters may have divided the large sawtimber crowns into several trees, or considered protruding branches within the crown canopy as individual trees. On a percentage basis the over-counts were particularly notice-

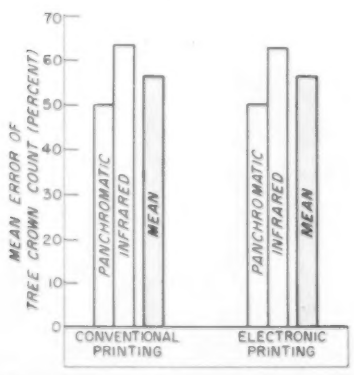

FIG. 2.—Summary of total mean error of the tests between printers and between the film-filter combinations.

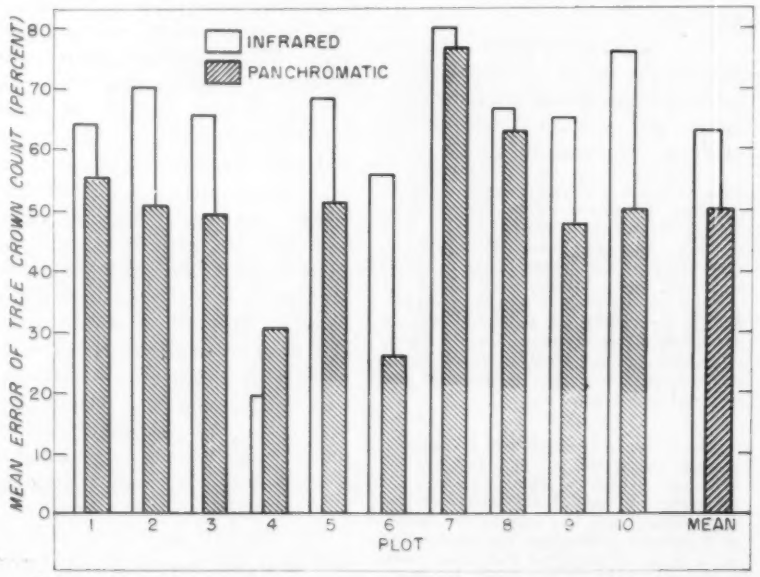

FIG. 3.—Mean error of crown count recovery between panchromatic and infrared photography, by individual plots.

able because the ground count on plot 4 was very low.

Interpreter Evaluation Test

The interpreters' evaluation of the prints concurred with the objective portion of the test. The interpreters unanimously selected the panchromatic photography for all the criteria considered. When broken down by printing methods within the two groups, however, opinion was divided. Two interpreters selected standard panchromatic prints as the best while the other felt that electronic panchromatic prints were superior to all others. All three interpreters preferred standard panchromatic prints for counting crowns of both hardwoods and conifers.

With infrared photography, interpreter opinion also varied. The men preferred electronic prints for counting conifer stands and conventional prints when counting hardwood stands. The electronic prints had lighter and sharper images in the conifer stands, but showed a loss of detail through lack of a sharp edge gradient on the hardwood crowns. When eye strain and fatigue were considered, standard panchromatic prints were the unanimous choice, while the other three prints were acceptable with about equal preference levels.

Discussion

Three principal factors account in varying degrees for the nonsignificant difference between the two printing methods.

Automatic printers may not sufficiently improve print contrast to bring out the steep edge gradient on fine detail necessary to make small crowns stand out from uniform background tones. The extra compression of contrast from the extremes of black and white toward an equilibrium point gives a flatter and grayer over-all appearance to the automatic print. Contrast compression may cause small crowns to merge with the background tones, thus nullifying possible improvement in gross detail.

The forest types and locations in the test may not have been so responsive to manipulations of printing as might other combinations of species, size class, density, topography, and aspect.

Considerable differences in print quality are often noted when inspecting aerial photographs, and can often be traced to the operator of a conventional printer, as electronic printers are very consistent. The prints for this project were all of uniformly high quality and thus electronic prints did not exhibit the advantages they might when operators of conventional printers turn out poor work.

Information observed and interpreted as individual tree crowns was apparently not influenced by the transfer method on any forest type in the test. The only noticeable difference between printing methods was the subjective evaluation by the interpreters.

Conclusions

In a study of medium-scale aerial photography of forest stands in northern Minnesota, little difference was found between full-scan electronic prints and conventional contact prints.

A highly significant difference in tree crown image recovery was found between the panchromatic and infrared photography used in the test. The difference was independent of the printing method and large enough to be of practical importance.

The photo interpreters showed a definite personal preference for the panchromatic photography and a general preference for the standard method of printing.

A possible advantage of electronic prints where cloud or topographic shadow is encountered was not investigated, nor were the effects of lesser degrees of scan upon image quality determined.

TABLE 2.—ANALYSIS OF VARIANCE OF MEAN ERRORS OF THE CROWN COUNT ON FOUR TYPES OF STEREO PHOTOGRAPHY

Source of variation	DF	Mean squares
Interpreters	2	314.31
Plots	9	903.27**
Error (a)	18	121.60
Total (a)	29	
Printing	1	.56
Plots × printing	9	12.99
Error (b)	20	9.72
Total (b)	59	
Film-filter	1	1,769.29**
Plots × film-filter	9	161.89**
Printing × film-filter	1	1.27
Plots × printing × film-filter	9	28.71
Error (c)	40	26.52
Total (c)	119	

**Significant at the 1-percent level.

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Plant Cover Reductions by Pocket Gophers Following Experimental Removal of Aspen from a Watershed Area in Utah

Richard B. Marston
and Odell Julander

WATERSHED managers are becoming interested in the feasibility of increasing volumes of water available for streamflow by making changes in watershed vegetation. In the Intermountain area, removal of only the aspen (*Populus tremuloides*) from a 1/10-acre area in Parrish Canyon, Davis County, Utah, increased the amount of water available for streamflow by decreasing the amount lost through evapo-transpiration (*1*). However, in the past few years observable marked reductions in the plant cover in this aspen-cleared plot have given rise to some fear that continuation of such reductions would decrease the total cover to an amount less than that required for protection against overland flow and erosion (*4*). This report notes the apparent role of pocket gophers in reducing plant cover on an aspen-free experimental area adjacent to an aspen-covered area.

Protective management of both aspen-covered and aspen-free areas began in 1936 with the elimination of livestock grazing and the start of fire protection. Since 1936 deer have grazed these areas lightly but no fires have occurred. Vegetal cover was similar from 1936 to 1947—a scrubby gnarled aspen overstory and a herbaceous understory—but during that period the total plant cover tripled, as estimated on permanent 100-square-foot point-observation plots (*5*).

Major differences between the areas were imposed in the spring of 1947 when one area was treated by removing all aspen; the other was left as an untreated check or control. Total plant cover on the untreated area continued to increase through 1949. After that it remained stable except for a moderate decrease in 1953, a drought year. Composition of the cover on this untreated area did change, however. A decrease in the density of grasses offset an increase in the important perennial forbs (Table 1). Since this appears to be a natural successional change for this type (*3*), this area serves well as a control for comparison with the treated area (Fig. 1).

Cutting off the aspen in the spring of 1947 and subsequently removing aspen sprouts converted the vegetal cover of the treated area to strictly herbaceous plants. Removal of the aspen immediately reduced the total plant cover, but this reduction was partially offset by a rapid increase in density of perennial grasses and forbs. This density continued to increase until 1951; then the total vegetal density was higher than before treatment, but was less than that on the untreated area. After 1951 the perennial plant cover decreased while annual plants and areas of bare ground increased (Table 2). For instance, all the grasses except *Stipa* decreased sharply, and the perennial forb, *Rudbeckia*, decreased steadily and rapidly. But *Madia*, an aggressive annual, invaded bare openings in 1955 and increased by 1957. Such a decrease in perennial plant cover after removal of aspen is contrary to what might be expected. Ellison and Houston (*2*) showed that openings in aspen are potentially more productive than areas within the aspen stand because of less competition from the overstory.

Examination of the treated area

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FIG. 1.—*Left*: Undisturbed aspen-covered area has almost complete cover of grasses, forbs, and aspen. *Right*: This area, cleared of aspen in 1947, has scattered perennial plants and large areas occupied by annuals.

TABLE 1.—AVERAGE FOLIAGE GROUND COVER[1] IN UNDISTURBED ASPEN AREA IN PARRISH CANYON

Species	Year								
	1936	1937	1945	1948	1949	1951	1953	1955	1957
	Percent								
Grasses									
Agropyron trachycaulum	0.28	0.39	4.96	8.05	10.72	8.27	6.45	7.60	3.89
Bromus carinatus	.19	.28	3.62	2.40	3.70	2.89	.35	1.65	1.48
Elymus glaucus	0	0	.12	.60	1.07	.80	.50	.40	.18
Stipa columbiana	.09	.08	.21	.41	1.02	.49	.32	.15	.21
Others	0	0	0	.17	.29	.02	.06	.18	0
Total	.56	.75	8.91	11.63	16.80	12.47	7.68	9.98	5.76
Perennial forbs									
Agastache urticifolia	.05	.08	.08	.11	.46	.33	.39	.45	1.04
Aster engelmanni	0	0	.11	.11	.22	.43	.43	.38	.74
Geranium fremonti	.10	.15	.09	.17	.29	.45	.52	.59	.60
Lathyrus utahensis	.02	.04	.01	.02	.24	.19	.47	.90	1.51
Lappula floribunda	0	0	.66	.49	1.00	1.79	1.59	1.86	2.87
Mertensia leonardi	0	0	.20	.12	.40	.93	.83	1.05	1.35
Rudbeckia occidentalis	3.55	3.98	8.25	7.95	12.12	12.70	12.47	13.25	9.78
Senecio serra	.14	0	1.00	.59	2.17	1.87	1.38	1.88	4.38
Valeriana scouleri	0	0	0	.60	2.16	3.29	2.09	2.65	2.73
Others	.18	.21	1.19	.06	.35	.68	.87	1.23	1.65
Total	4.04	4.46	11.59	10.22	19.41	22.66	21.04	24.24	26.65
Annual forbs									
Gayophytum ramossisimum	.35	.44	T	T	T	T	T	T	.02
Madia glomerata	0	0	0	0	0	0	0	0	0
Polygonum douglasi	1.14	1.30	.05	.14	.82	2.34	.41	1.55	.69
Others	.46	.42	.31	.03	.44	.13	T	.34	1.44
Total	1.95	2.16	.36	.17	1.26	2.47	.41	1.89	2.15
Woody plants									
Populus tremuloides	2.08	1.98	7.88	6.50	7.77	6.16	6.29	8.16	5.43
Rosa woodsi	.06	.06	.01	.15	.41	.37	.43	.49	.70
Symphoricarpos oreophilus	.40	.42	1.94	2.32	3.59	3.26	3.01	4.12	4.63
Total	2.54	2.46	9.83	8.97	11.77	9.79	9.73	12.77	10.76
Total vegetative cover	9.09	9.83	30.69	30.99	49.24	47.39	38.86	48.88	45.32

[1]Estimated ocularly on 10 permanent 100-square-foot plots.

TABLE 2.—AVERAGE FOLIAGE GROUND COVER[1] BEFORE AND AFTER ASPEN REMOVAL (1947) FROM EXPERIMENTAL AREAS IN PARRISH CANYON

Species	Year								
	Before aspen removal				After aspen removal				
	1936	1937	1945	1948	1949	1951	1953	1955	1957
	Percent								
Grasses									
Agropyron trachycaulum	0.16	0.12	5.91	5.48	6.98	8.69	3.51	4.15	3.61
Bromus carinatus	.36	.85	5.35	2.61	4.01	2.29	.06	1.24	.08
Elymus glaucus	0	.04	3.45	3.11	2.95	1.84	.20	.07	.02
Stipa columbiana	T	T	.10	.02	.11	.17	.18	.02	.34
Others	.05	.05	0	0	T	.27	.21	.01	0
Total	.57	1.06	14.81	11.22	14.05	13.26	4.16	5.49	4.05
Perennial forbs									
Lappula floribunda	0	0	.31	.73	1.12	1.78	2.52	2.86	2.84
Mertensia leonardi	.01	.02	.20	.50	.65	2.31	3.11	4.37	4.69
Rudbeckia occidentalis	2.38	3.45	6.96	5.67	6.82	3.94	2.03	1.12	.44
Senecio serra	.12	.20	.32	.24	.36	.99	1.33	1.32	1.11
Valeriana scouleri	0	0	0	.67	1.53	1.68	1.77	1.40	.62
Others	.03	.11	1.02	.37	1.04	1.92	1.53	1.03	1.65
Total	2.54	3.78	8.81	8.18	11.52	12.62	12.29	12.10	11.35
Annual forbs									
Gayophytum ramossisimum	.88	.88	.05	T	.07	.08	.22	2.78	.73
Madia glomerata	0	0	0	0	0	0	0	T	.38
Polygonum douglasi	1.44	2.10	.54	.05	1.21	7.76	4.72	2.89	3.80
Others	.72	.42	.53	.04	.22	.09	.02	.09	.54
Total	3.04	3.40	1.12	.09	1.50	7.93	4.96	5.76	5.45
Woody plants									
Populus tremuloides	1.50	1.19	7.42	0	0	0	0	0	0
Total vegetative cover	7.65	9.43	32.16	19.49	27.07	33.81	21.41	23.35	20.85

[1]Estimated ocularly on 10 permanent 100-square-foot plots.

in the fall of 1957 indicated that pocket gophers (*Thomomys talpoides*) had caused much of the recent vegetal deterioration. Dead plants of that year and remains of older root crowns of *Agropyron, Elymus, Rudbeckia, Senecio,* and *Valeriana* were found. Pocket gophers had undermined and destroyed roots and root crowns of every one of these dead perennials. Signs of the presence of smaller rodents, especially mice, were evident in spots, but destruction of plants by them could not be detected.

Counts in 1958 showed that pocket gopher mounds were twice as numerous on the treated as on the untreated area. This difference was highly significant statistically.

Forbs killed recently and those having damaged roots were also more numerous on the treated than on the untreated area (Table 3).

TABLE 3.—PLANTS INJURED BY GOPHERS[1] ON ASPEN-CLEARED AND UNDISTURBED AREAS IN PARRISH CANYON, 1958

Species	Aspen-cleared			Undisturbed area		
	Uninjured	Injured	Dead	Uninjured	Injured	Dead
	Percent					
Perennial forbs						
Agastache urticifolia	—	—	—	100	0	0
Aster engelmanni	—	—	—	100	0	0
Geranium fremonti	—	—	—	50	50	0
Lathyrus utahensis	—	—	—	100	0	0
Lappula floribunda	100	0	0	100	0	0
Mertensia leonardi	25	75	0	100	0	0
Rudbeckia occidentalis	0	75	25	91	6	3
Senecio serra	44	50	6	63	33	4
Valeriana scouleri	50	38	12	86	9	5
Grasses						
Agropyron trachycaulum	85	10	5	95	5	0
Bromus carinatus	85	10	5	95	5	0
Stipa columbiana	100	0	0	100	0	0

[1]The cleared area had gopher mounds at the rate of 400 per acre; on the undisturbed area the rate was only 210 per acre.

Rudbeckia and *Valeriana* had the highest mortality. These two species have decreased most on the treated area since 1951; however, they have both persisted well and are important species on the untreated area. *Senecio* has increased on both areas, but the considerable gopher damage on the treated area has kept its increase small.

The major part of the perennial forb cover of the treated area is now *Lappula* and *Mertensia.* Gophers did not damage *Lappula.* They damaged many of the outer roots of *Mertensia* but killed no plants in either 1957 or 1958; they attacked all the heavy, woody root crowns but did not seriously injure them.

Grass cover has decreased in recent years on both areas. On the untreated area the decrease could logically be attributed to increasing competition from vigorous forbs. On the treated area, however, with less than half as much forb cover, the decrease in grasses appeared to be related to rodent foraging. Grass species damaged by gophers decreased most, whereas the undamaged grass, *Stipa,* tended to increase.

Gophers damaged some plants on the untreated area, especially *Geranium, Rudbeckia, Senecio,* and *Valeriana.* While development of these particular species in the stand was probably curtailed by gophers, the total plant cover appears not to have been influenced materially. Probably some forbs might have become more abundant and others less abundant if no gophers had been present.

In many type conversion studies in the past livestock constituted the primary or sole animal influence considered. In the present study the trend in vegetation and soil cover on the converted type suggests that an unsatisfactory watershed condition may be developing even though livestock have been excluded from the area. Gophers here definitely present an ecological problem. Elsewhere other animals, including big game, rabbits, and mice, have also been known to influence volume and composition of vegetative cover greatly following changes in environmental factors.

Further research on this problem of rodent damage is needed before vegetative conversion of the aspen type can be recommended for increasing water yield. In any plan to manipulate ground cover the entire biotic community must be considered, including the factors favoring the build-up of agencies destructive to vegetal cover and possible control of such agencies.

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A Hemispherical Forest Photocanopymeter[1]

Frank G. Clark

A PINHOLE CAMERA of wide angle range facing skyward, developed at the Central Sierra Snow Laboratory, has been found useful for measuring and permanently recording the forest canopy over experimental sites. Construction of the instrument, the photocanopymeter, its calibration, and some uses in analysis of forest cover are outlined in this paper.[2]

The Instrument

The essential parts of the photocanopymeter (Fig. 1) are a 4×5 Graflex film pack holder, a pinhole lens of brass shim stock, a light tight box of soft wood and sheet metal to house and position the film pack, and the lens piece.[3]

A satisfactory working model was constructed as follows:

To contain the film pack holder, a shallow wood box frame of one-inch stock was milled, with light-tight slots along three sides to accept the holder. A lens board cut from a piece of 26-gauge galvanized sheet metal, with a ¾-inch hole in its center to accommodate the pinhole lens piece, was screwed to the top at a distance of 0.315 inches above the position of the negative in the film pack. The box was painted black inside and out, and a piece of black felt was glued to form a light trap across the open slot between the sheet metal lens board and the top of the film pack at the open end of the wooden frame. Finished size was 6×7×2 inches.

The only critical piece of work was the lens hole. This was fashioned from a 1½ inch square piece of brass shim stock 0.003 inch thick. Pinholes were drilled through several pieces with a 0.020 inch jeweler's twist drill. A microscope was used to select a pinhole which had a minimum of irregularities and a maximum of sharply defined roundness.

A simple sunshield was made of a piece of 18-gauge tinned copper wire about 8 inches long with a disk of thin brass ¼ inch in diameter soldered to the free end. This was fastened to one of the "south" corners of the wooden camera box. The device was adjusted to shade the aperture from direct sunlight during film exposure, preventing sun streaks on the negative.

The cover, a U-shaped piece of 26-gauge galvanized sheet metal, was friction fitted so as to slide over the top of the camera. This was used both to keep the pinhole protected in transit and as a manually operated slide shutter during film exposure.

The camera as described gives a picture covering about 85 percent of the hemisphere.

Calibration of the Instrument

In calibrating the pinhole camera, these geometric relations hold:

1. The proportion of the hemisphere (sky) for various angles above the horizon is given by the sine of the angle above the horizon (sin h).

2. The projection distance of any point in the sky from the center of the film (D) is given by the co-tangent of the angle (h) (above the horizon) times the "focal length" (f) of the camera (that is the distance from the pinhole to the film surface—0.315 inches in our camera).

So if we want to divide a photo of the hemisphere into ten equal segments from horizon to zenith, we measure these distances from the center of the photo: 9.960f, 4.900f, 3.180f, 2.291f, 1.732f, 1.333f, 1.020f, 0.750f, and 0.484f. Concentric circles are then laid out. If the photo is further divided by radial lines 36 degrees apart, we have a grid of segments of equal area, each containing 1 percent of the hemisphere (Fig. 2).

To estimate shade by the canopy, we have made grids which show solar paths across the photos (Fig. 2). To make these grids we take the sun altitude angle (h) for various dates (we have used declinations of −22°45′, −15°45′, −5°15′ +6°24′, +16°40′, and +22°20′ to represent seasonal changes) and for various hours of the day. The hour angle and sun angle can be read from Table 170 of the *Smithsonian Meteorological Tables* (6th edition). The positions of the sun can then be plotted on the hemispherical grid, plotting the sun angle (h) at 100 (1- sin h).

For example, for May 1 (declination +15°), for 9:40 a.m., hour angle 30 from east, at latitude 40° N, the sun angle is 50°; 100 (1- sin 50) gives 23.4 percent. So one

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[1]This instrument was developed as part of the California Cooperative Snow Management Research, being conducted by the U. S. Forest Service with the cooperation of the State of California, Department of Water Resources.

[2]The possibility of obtaining records of forest canopy photographically was first suggested by Ashton R. Codd, Soil Conservation Service, Bozeman, Mont.

[3]The whole back of a Graflex Speed Graphic has been suggested as an alternative to the wooden box. A metal plate, with a pinhole, bolted to this back would complete the essentials of the photocanopymeter. Letter from Marvin Hoover, July 15, 1959, Rocky Mountain Forest and Range Expt. Sta., Fort Collins, Colo.

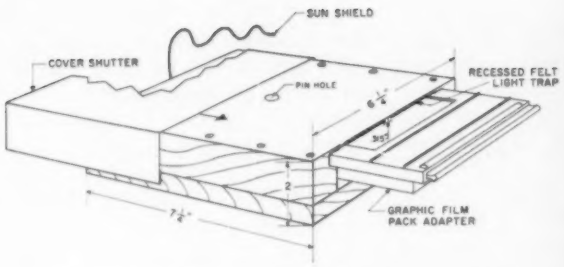

FIG. 1.—The hemispherical forest photocanopymeter.

FIG. 2.—Photocanopy picture of snow sampling point showing hemispherical cover grid and solar paths for latitude 40° N.

point on the path of the sun is at 23 percent on the hemispherical grid and on the line 30° from east. By repeating this process at other times during the day and year, paths of the sun can be laid out on the grid. The solar path for May 1 and December 22 when the solar declinations are +15°00′ and −23° 27′ is shown in Figure 2.

A check on the hemispherical grid was effected by mounting the camera on a tripod facing a bare wall. Grid points of known angles from the camera pinhole were mounted on the wall. The theoretical and check positions on the film agreed closely.

Field Use of the Instrument

When in field use, leveling of the camera is obtained either by mounting it on a tripod and leveling the top, or by use of a field compass fastened to a tripod. In the latter case, the compass was leveled, the slide was removed, and the camera was then oriented on top of the compass with the pinhole lens facing the zenith. The lens shade was positioned, the photographer bent over in order to be out of range of the camera, and then the slide shutter was opened, and the exposure was made. A wide latitude panchromatic film, such as Verichrome, was found to be entirely satisfactory. We found that exposure timing was not critical, and 2 seconds in bright sun and 4-8 seconds with sky overcast or under adverse light conditions provided satisfactory negatives.

Consistent results depend on placing the tab end of the film pack always due South and keeping an accurate account of the date, hour, timing, location, and number of each exposure made.

In our use, the slope of the terrain was recorded, but the camera was always used in the horizontal position to keep a consistent zenith. For a special purpose, such as study of shelter from winds, the camera might be oriented parallel to the slope. Tree movement due to wind was not appreciable, but is certainly a factor which should be taken into account as a possible source of error.

Analysis of the Data

Interpretation of the photo is done at present by one of two ocular techniques. Analysis is aided by transparent grids, as previously described, overlayed on the negatives. A pinhole placed at the center and one corner of each grid overlay was used to prick corresponding holes on each negative as it came up for analysis. This procedure aided in fixing points of reference for repeated examination. The zenith was located on each negative by lining up trees on the grid, since all trees are assumed to grow vertically (how fortunate) and so point to the zenith. It was found that the zenith wandered a bit on the negatives, possibly because the camera was off level or because of a minute variation in the film pack itself.

The method of determining forest canopy from the negatives will depend on the person doing the analysis and his objectives. A dot counting system, a visual fractional estimate of each segment, or a "packing" method of combining light areas and dark areas of adjacent blocks of each segment are possible means of obtaining cover density. So far we have used the visual fraction in each segment, adding these to get total hemispherical cover or breakdown of the cover distribution.

Discussion

In our analyses[4] we have used several breakdowns of the cover: (1) total hemispherical cover, to index intereception of sky radiation, (2) cover in the top 10 percent of the sky surrounding the zenith, to index intereception of precipitation,

[4]Anderson, H. W., R. M. Rice, and A. J. West. Forest shade related to snow accumulation. 26th Ann. Proc. Western Snow Conf. pp. 21-31. 1958.

(3) cover in the north hemisphere, to index back radiation of trees, (4) cover in various paths of the sun, to indicate shading, and (5) cover in various quadrants, to indicate shelter from or exposure to the winds. It seems obvious that on steep slopes the shelter from the wind and cold air drainage may not be properly expressed by cover as "seen" in these "level" photos. It might be desirable on steep slopes to have a photo with the plate parallel to the slope, as well as a level exposure. We take our photocanopy pictures in the forest at fixed points in a square grid. By using a little trigonometry we can then get the tree heights and distances.

Investigations in which this camera is being or might be useful include studies of the relation between crown cover and the composition and survival of species on the forest floor, the differences between openings before and after a logging operation, the setting up of a permanent record of the exposure and shelter environment of weather stations and snow courses.

The author wishes to acknowledge suggestions of A. R. Codd, H. W. Anderson, C. H. Gleason, and R. M. Rice in the development and use of the CSSL photocanopymeter in recording and analysis of forest canopy cover.

Natural Root Grafting in Northern Wisconsin

Theodore T. Kozlowski and John H. Cooley

OBSERVATIONS in northern Wisconsin during the summer of 1959 show that natural root grafting is exceedingly common in a number of species of gymnospermous and angiospermous trees. The results of this study may have several important silvicultural implications.

Natural root grafting has been reported for several Temperate and Tropical Zone trees, (*1, 2, 3, 5, 6, 7, 8, 10*). In the Wisconsin study, conducted at the Argonne Experimental Forest, Forest County, root grafting was observed between different trees of the same species in sugar maple (*Acer saccharum* Marsh.), red maple (*Acer rubrum* L.), yellow birch (*Betula alleghaniensis* Britton), white birch (*Betula papyrifera* Marsh.), white pine (*Pinus strobus* L.), red pine (*Pinus resinosa* Ait.), Balsam fir (*Abies balsamea* [L.] Mill.), eastern hemlock (*Tsuga canadensis* [L.] Carr.) and northern white-cedar (*Thuja occidentalis* L.). Intraspecific grafting also is common in northern pin oak (*Quercus ellipsoidalis* E. J. Hill) and bur oak (*Quercus macrocarpa* Michx.) in Wisconsin (*6*).

Root fusions occur in both saplings and older trees but they are more common in older trees. Although grafting of the larger roots is most common, roots as small as ⅛ inch in diameter were found to graft, usually to roots of considerably greater diameter. The main requirement for intraspecific root grafting appears to be growth pressure. Feeder roots do not graft readily. The angle of approach does not seem very important as roots were found to graft at various acute angles as well as right angles. In addition to established grafts many cases of abrasion and callus development were observed where roots crossed suggesting that fusions would eventually occur as a result of growth pressure at these points of contact.

Root grafting is common over a stone or adjacent to a stone, and several roots may graft when they converge and cross a sharp stone edge (Fig. 1). Apparently the diameter-growth pressure of a root on another root lodged against a stone promotes grafting. However, the presence of stones is not necessary for grafting for many root fusions were observed where there were no stones.

A number of root systems of adjacent trees were washed out

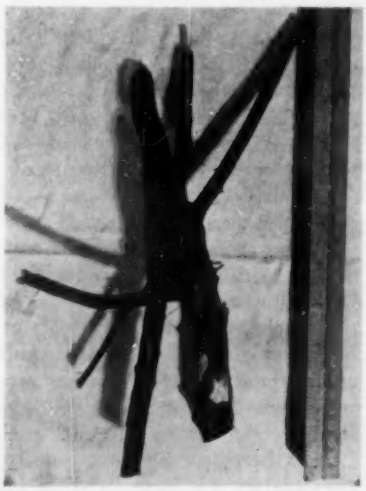

FIG. 1.—Fused roots of sugar maple. This compound graft was formed on top of a stone edge where the several roots crossed.

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The authors acknowledge the cooperation of the Wisconsin Conservation Department in this study.

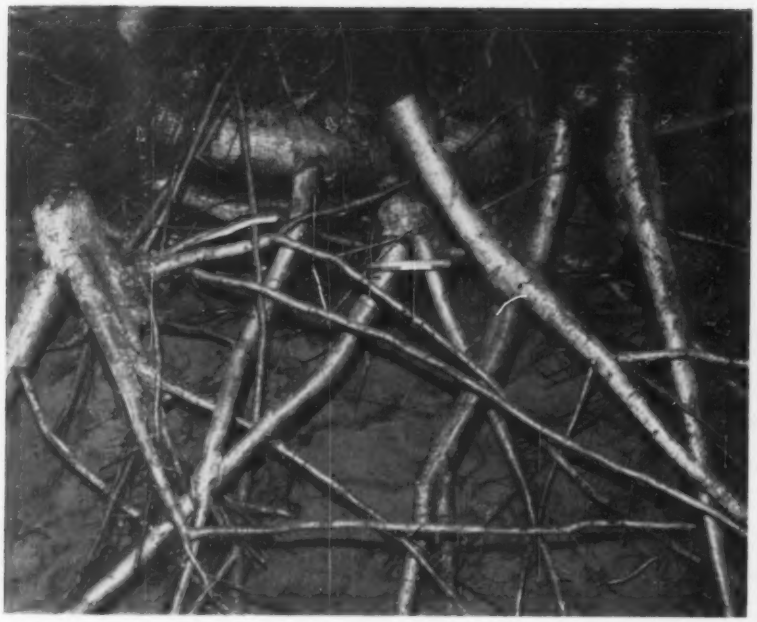

FIG. 2.—Root fusions in closely grown balsam fir. The stems were approximately 1.5 feet apart. The d.b.h. of the central tree was 4.0 inches and that of the two other trees 6.0 and 6.4 inches.

FIG. 3.—Fused vertical roots of a yellow birch tree which germinated on a high stump.

and photographed. Then selected portions of root systems which appeared to be fused were removed for sectioning. The duff and litter were carefully removed and the soil washed away with a fine stream of water from a hose attached to a portable pumper.

Observations on the root systems of six adjacent sugar maple trees are used for illustration. The root systems were washed out to an 18-inch depth. The distance between trees varied from 1.4 to 6.6 feet. Four of the trees were small, suppressed saplings with d.b.h.'s of 1.7, 2.0, 2.3, and 2.4 inches. The other two trees were dominants with d.b.h.'s of 10.5 and 11.0 inches. The feeder roots of the saplings were confined essentially to a 6-inch depth, and none of these appeared to be grafted. However, the roots of two of the saplings and the two dominants were thoroughly grafted. It is believed that these trees may represent an interconnected physiological unit rather than four individuals; there were many root grafts within the same tree and many between trees. In this 4-tree complex one root approximately ½ inch in diameter was fused to six other roots, including roots of two other trees. A number of these root grafts were removed for further study. Later sectioning showed that the fusions were real and that there were actual unions of vascular elements and a common cambium. A common situation was noted in which small roots of one tree run more or less perpendicularly to the roots of an adjacent tree and are woven among them. As such roots increase in diameter, growth pressure eventually causes wearing away of bark and eventual tissue fusions.

Some species show a much greater tendency to root graft than do others. In balsam fir, for example, the tendency was strong. Root systems of several upland, closely grown balsam fir trees that were 4 to 6 inches d.b.h. were washed out to a 2-foot depth. The stems of these trees were only one to two feet apart. The trees were bound together in units by numerous grafts of the larger roots (Fig. 2).

Rigg and Harrar (*10*) observed considerable root grafting of bog species. They concluded that wind sway was instrumental in causing the bark of roots to be worn off where they come in contact in the complicated ramifying growth of roots in sphagnum. However, the present study indicates that balsam fir roots will graft readily even when trees are firmly rooted in soil. Their compatibility for grafting and the growth pressure of contiguous roots apparently fulfill the requirements for union. LaRue (*7*) also emphasized that swaying was not critical for root fusions in compatible species. He found root grafting of white pine trees growing in stiff clay, when they could not have swayed sufficiently to wear away root bark by friction.

True interspecific grafting was not observed and from the literature appears to be uncommon. Roots of a number of closely grown trees of different species were examined. Although the roots of several trees were found buried in those of another and appeared to be grafted, sectioning indicated that a bark layer separated the two, and there was no indication of element fusion or of a common cambium. This was the usual case when large trees of different species were found growing closely together. The growth pressure of these adjacent large roots must have been great yet their incom-

patibility was demonstrated by failure to form true root fusions. The situation usually was misleading, however, until the roots were sectioned, for at first examination they appeared to be grafted. According to Nienstaedt et al. (*9*) the following steps usually occur in true grafting; formation of a contact layer; development of callus; elimination of the contact layer and beginning of callus differentiation; union of vascular elements; and formation of a common cambium.

A number of interesting grafts were observed in the aerial roots of individual yellow birch trees. Aerial roots result when yellow birch seed germinates on an old stump and sends roots downward. Eventually the stump decays and the tree is supported by aerial "stilt" roots. Such roots often are completely fused (Fig. 3). Grafted aerial roots were found at varying heights up to 12 feet above ground level. In addition, many grafted horizontal aerial roots of yellow birch were found where the seedling apparently germinated on a felled log and the roots ran laterally along the log. Finally, after the log decayed, the tree was supported by essentially horizontal aerial roots. In one case a number of aerial roots extended horizontally for a distance of 20 feet before turning downward into the soil. The above-ground portions were a fused mass of horizontal, almost parallel roots extending outward at a height of approximately 2½ feet off the ground (Fig. 4).

FIG. 4.—Fused mass of horizontal aerial roots of yellow birch.

The extensive root grafting observed prompts questions about the physiological implications involved regarding the extent of parasitism which occurs between trees. It is well known that diseases such as oak wilt are spread through root grafts (*6*). Cook and Welch (*5*) and Bormann and Graham (*4*) have reported that herbicides applied to individual trees were translocated through fused roots and killed adjacent trees. At present little quantitative information is available on the extent of movement of water, organic solutes, and minerals normally through root grafts under favorable environmental conditions and under environmental stress. Do these substances usually move from suppressed to dominant trees or vice versa, and in what amounts do they move? Kuntz and Riker (*6*) reported that movement of moisture in northern pin oaks occurred in both directions, but most often it occurred from dominant to suppressed trees. Additional quantitative information on these fundamental physiological questions is needed, for it could have a bearing on revision of present concepts of tolerance; these do not now differentiate between abilities of species that root graft readily and those that do not to survive under environmental stresses. Still other silvicultural implications may be involved in root grafting. Adams (*1*) for example observed that root fusions in a 26-year-old Monterey pine stand were only eight years old. He suggested that the prompt response of Monterey pine stands to heavy late thinning, in contrast to poor response to early thinning, may have been partly attributable to the presence of root fusions in older stands.

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Seasonal Changes in Cold Resistance of Some Northeastern Woody Evergreens

Johnson Parker

IT IS a curious thing that so little is known about cold resistance of North American forest trees. Although a great deal has been written about the theories of cold resistance, very few precise measurements have actually been made of the resistance of common woody plants to cold. Even field studies like that of Kriebel (*5*) have only rarely been made. Although a number of studies of the growth of exotic trees have been initiated by the U. S. Forest Service and have yielded some very valuable data, these studies have been carried out with the goal of growing trees successfully, not with the hope of their demise. One study, carried on by the Southern Forest Experiment Station, has shown that longleaf pine can grow quite well in western Tennessee (*18*), well north of its natural range. However, it still cannot withstand the rigorous winters of most northern states over a period of years, judging by our work in Idaho.

Much of the work that has been done on cold hardiness of trees in North America has been carried out with the idea of explaining the cause of hardiness change with the season (*17*). A few studies on cold hardiness have been made directly on trees in the field with a portable cooling apparatus (*1*) and the author has made similar studies with severed twigs in the laboratory (*9, 10*). Recent work in Austria (*6, 12*) and in Japan (*14*) has indicated that this is a fertile field of study and much has yet to be learned about cold resistance. A program of study of cold resistance was therefore undertaken at Yale to determine, among other things, how much variation in hardiness there was among some common woody plant species and how this hardiness changed with the season.

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Methods

In a single quarter-acre area of the Whitney Lake region in Hamden, Connecticut, three individuals each of hemlock (*Tsuga canadensis* [L.] Carr.), white pine (*Pinus strobus* L.) and mountain laurel (*Kalmia latifolia* L.) were selected and numbered. So far as is known, all species were local races and native to southern Connecticut. Both pines and hemlocks 20 to 30 feet tall were growing under a mixed stand of oak and hickory. Only the lower branches four feet above ground were sampled. The laurels, about four feet tall, were also growing under the oak-hickory stand.

Samples consisting of five-inch long terminal shoots were cut from the tree with pruning shears and brought to the laboratory in ten minutes where they were placed in Dewar flasks for the cooling treatment as previously described (*11*). The low temperature apparatus was a compressor type with compartment large enough for four Dewar flasks. This has been briefly described elsewhere (*11*). Leaves were kept in the Dewar flasks at 2°C. for 24 hours after cutting from the trees or shrubs in the field at about 8:00 a.m. They were then cooled down to a certain temperature at a rate of 4°C. per hour and warmed at a rate of 8°C. per hour.

Viability of leaves was determined by placing them in a glass desiccator with tap water in the bottom to give a relative humidity of about 99 percent at 22°C. Untreated (control) leaves could be kept alive for over a month under these conditions as indicated by their green, flexible condition and a positive tetrazolium test (*9, 10*). Cold-treated leaves were kept for at least a month in order to decide on their viability. Injury was indicated by discoloration to dull green which was followed in time by their turning brown.

Sugar levels, briefly mentioned in the results, were determined as described previously (*11*).

Results

During the summer all species were resistant to about —8°C. (Fig. 1). There was enough variation among individuals that species differences were not significantly different. With the advent of cooler weather in mid-September, pine showed an increase in its hardiness but there was little response in the other two species (Fig. 1). By the time of the first autumn frost, pine had already developed a hardiness of nearly —25°C., laurel about —17, and hemlock —15 at the rates of cooling and warming specified. As autumn proceeded, hemlock lagged even further behind the other species and pine continued to develop hardiness most rapidly. These species differences were consistent for all individuals provided the youngest leaves were used in the tests and densely shaded plants were omitted. Some densely shaded laurels near the test area remained less hardy than those in the open. This was found to be related to a higher sugar content in the more open-grown plants. Older leaves (second year) of both pine and hemlock by midwinter were more sensitive than younger (first year) leaves at this time and second-year hemlock leaves never obtained a hardiness greater than —48°C. throughout the winter. These differences did not appear to be related to sugar content. By mid-

winter the youngest (first year) leaves of all other plants of all three species were resistant to more than —80°C.

In early March the young hemlock leaves began to show a greater sensitivity to the cold treatment (Fig. 1) even though there was only a slight warming trend at that time. By April, when substantially warmer weather arrived, all three species dehardened so rapidly that it was difficult to make enough measurements to follow these changes. Laurel appeared to deharden somewhat more slowly than pine but this was not a distinct difference. By May all species were nearly in the summer condition.

It became increasingly apparent in the course of this work that rates of cooling and warming the samples in the apparatus were often deciding factors in the results obtained. For example, in late autumn leaves cooled to —60°C. at 4°C. change per hour and warmed at 5°C. change per hour survived, yet leaves cooled at the same rate to only —45°C. and then warmed at 10°C. change per hour were killed. This serves to illustrate the elusiveness of absolute lethal levels of temperature, although such levels are often

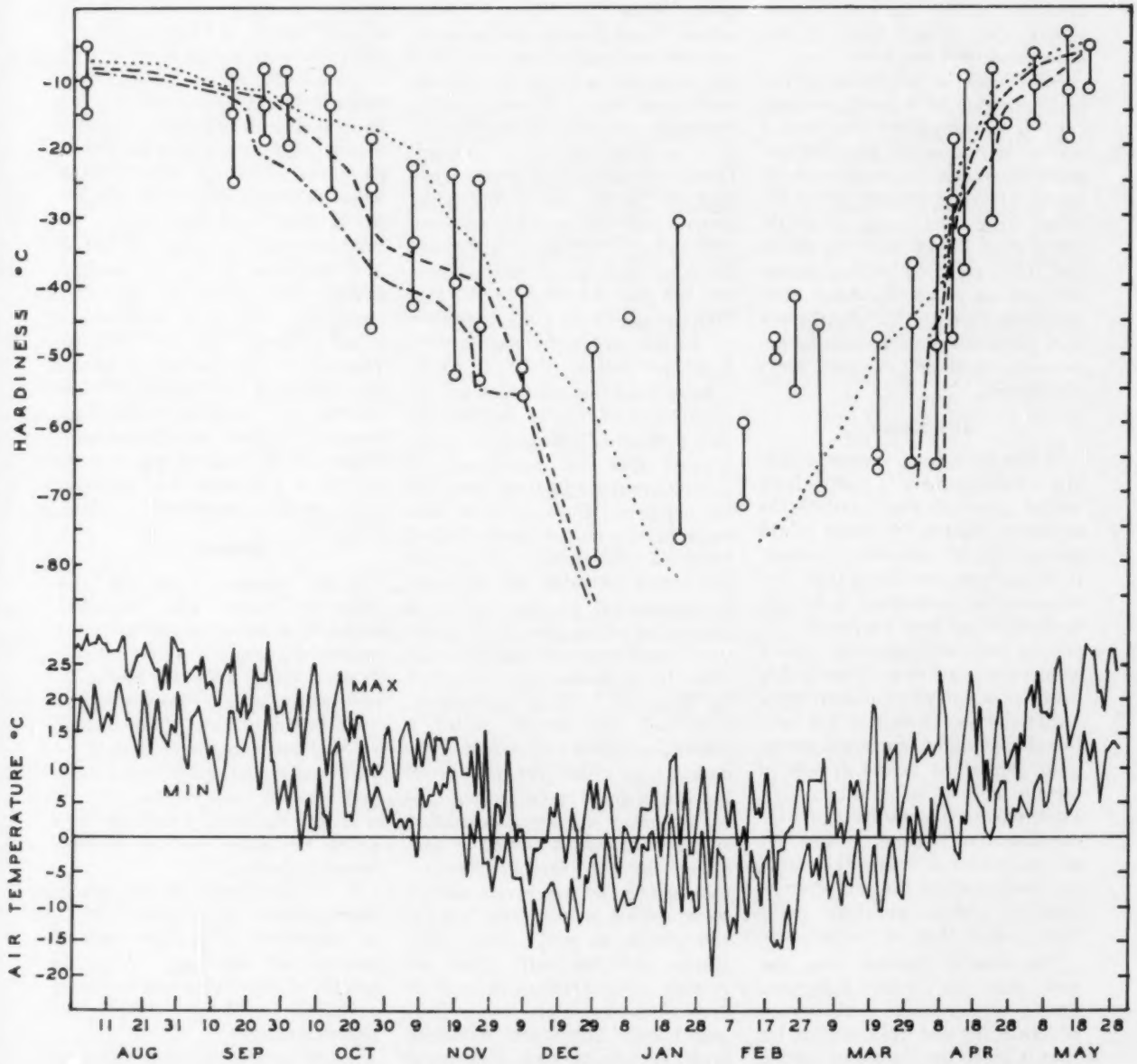

FIG. 1.—Maximum and minimum daily temperatures measured at the New Haven airport for August 1958 to June 1959 are shown at the bottom. Above this are presented curves for cold hardiness for the three species: dotted line, hemlock; dashed, laurel; dot-dashed, white pine. Each curve is the average of three trees and is drawn so that it goes above test temperatures that killed the leaves and below temperatures that failed to kill them. Test temperatures are indicated by circles; the vertical lines connect tests made on the same day.

stated with great certainty in the literature.

Further studies carried on at the same time with hemlock and white pine from another location (North Branford) showed that in localities further away from the ameliorating effect of large bodies of water, hardiness may develop more rapidly in autumn. There was no reason to suppose that this difference in the two localities was the result of genetic differences. In the North Branford location hemlock again hardened more slowly than pine, both in the autumn of 1958 and 1959.

Since none of the plants shown in Figure 1 were injured at about —80°C. in midwinter, it seemed a matter of interest to find out how much they could be cooled without injury. During March, after the usual slow cooling to —80°C., white pine leaves were placed in test tubes and immersed in liquid nitrogen at —189°C. After slow warming (about 8°C. change per hour) leaves were found to be apparently viable for several weeks afterwards.

Discussion

It has long been supposed that low temperatures, particularly winter minima, may control the northern ranges of many plant species (*13, 16*), but more frequently it has been postulated that they are not the controlling influence. Instead, it has been suggested that growth rates and growing season temperatures are more important to survival in competition with other native species. In fact, it has been found that night temperatures are quite important to the growth of certain species of conifers (*4*). Furthermore, the survival of various species of trees at the tree line on mountains or along the northern borders of the range is often related to certain moisture conditions rather than to temperature.

The results reported here suggest that the main differences among species reside in their rates of hardening and dehardening, but that if given the chance to harden, they are capable of withstanding enormously low temperatures. In the field, however, midwinter damage is more often caused by winter drying, than by the direct effects of cold itself (*9*). A good example of this occurred in the winter of 1958-1959 (Fig. 1) in Connecticut and evidently in many other parts of the Northeast. Laurels were frequently injured and sometimes entirely killed, although these are native to the region; other evergreens, including native hemlocks and white pine, particularly as seedlings in nurseries, were injured by the hard winter. This was the result of prolonged temperatures below the freezing point which, together with lack of snow, resulted in deeply frozen soil. But also branches and trunks of trees were often frozen. Although xylary freezing commonly occurs in nature without apparent damage, transpiration conditions were such that the leaves dehydrated while water could not be replaced from the stems. The fact that some branches had frozen while others had not was indicated by the fact that leaves of only a single branch of a pine or laurel shrub were sometimes killed.

In spite of this argument for the importance of winter drying, the direct effects of cold should not be ignored and are recognized as serious problems in forest practice in northern Europe. The cold wave in the northwestern United States in 1955 caused very definite damage to native as well as exotic evergreens (*2, 3*) and caused a great deal of damage to horticultural crop trees. A similar cold wave in December was described by Schreiner (*15*) in the same region and this largely killed a plantation of Pacific coast ponderosa pine which had been growing successfully in northern Idaho for a number of years. A somewhat similar cold wave occurred in midwinter in the eastern Mediterranean (*8*) and was severe enough to injure not only exotics, but native plants as well. One exotic woody vine (Lonicera) which had become established as a pest in orchards and gardens was entirely wiped out. There are numerous other reports of such cold waves in the literature, yet many writers on the subject seem to be unaware of them.

It may be argued that such cold waves do not kill native plants and that they recover from injury later on. This may be true, but trees that are native to a particular region have been growing there for many generations and have probably been the survivors of considerably worse cold periods that occurred long ago and which were not recorded. If damage can occur in only recent times to native, apparently well-established species in the present era of warming climate (indicated by glacial withdrawal, weather records, and other phenomena), then it is likely that more severe damage would occur during a period of cooling climate. Such damage might not eventually be expressed in clear terms, but might become confounded with the effects of parasites which often attack weakened trees. The fact still remains that there are some good relationships between isotherms and northern borders of certain species (*7*). Although this may eventually be best related to a physiological function such as respiration rate, one cannot escape the fact that the success of any species in a particular habitat depends on a whole series of adaptations, not the least of which is its ability to withstand low temperatures in these temperate climates.

Summary

1. By means of cooling and warming twigs with attached leaves in a temperature-controlled apparatus, hemlock (*Tsuga canadensis*), laurel (*Kalmia latifolia*), and white pine (*Pinus strobus*) were found to have characteristic rates of hardening in autumn. Pine hardened most rapidly, laurel next, and hemlock most slowly.

2. In summer, hardiness was about the same for all species, namely, about —8°C.

3. Young leaves of all species were resistant to at least —80°C. in midwinter using slow rates of cooling and warming. A single sample of white pine was cooled to —189°C. in March without apparent damage.

4. In spring, hemlock began to deharden earliest although all species rapidly dehardened when substantially warm weather arrived.

5. The more shaded individuals of laurel never developed the deep winter hardiness of the open-grown plants and had a lower sugar content than the latter.

6. Two-year-old hemlock leaves were much less resistant to cold than the youngest leaves in mid-winter, but were generally hardier than the youngest leaves in summer. This difference was unrelated to sugar content.

7. Rates of cooling and warming were found to be quite important to levels of resistance measured, so that rates of cooling and warming should be specified.

8. Killing of laurel and some branches of hemlock and pine in the field as well as seedlings in nurseries was observed in the winter of testing. This was believed to be the result of winter drying brought on by frozen soil and frozen xylary water together with a certain amount of transpiration.

9. The role of temperature in determining northern limitations of forest trees is discussed. Although winter drying appears to be a more serious cause of damage than direct cold, the latter can cause serious difficulty to exotics and on rare occasions even to native plants.

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As We Went to Press

Lumber Seasoning Course and Kiln Drying Demonstration—The University of Washington and the Institute of Forest Products, Seattle, March 20-25.

Hardwood Lumber Grading Short Course—The Pennsylvania State University, University Park, March 27-31.

North American Wildlife Conference, March 6-8, Statler-Hilton Hotel, Washington, D. C.

Washington Section, SAF, holds an all-day meeting, Feb. 16. Visitors invited.

Filtration of Maple Sirup

C. O. Willits, H. A. Frank,
and J. C. Underwood

THE PRODUCTION of sirup by atmospheric evaporation of maple sap is exclusively a farm operation. Most maple sirups, as they leave the evaporator, contain varying amounts of suspended matter which cause the sirups to have a cloudy appearance. These suspended solids are principally the calcium and magnesium salts of malic and other organic acids. The extent of this cloudiness influences the price paid for sirups. Further, sirups intended for table use, sold directly or indirectly to the consumer, must be essentially free of cloud to meet state and federal requirements. Since the highest prices are paid for those sirups having a minimum of cloud, and since table sirups must be essentially free of cloud, it is of great economic importance to the maple sirup producer that he clarify his sirups and that he employ the most efficient method available.

Clarification is occasionally done by sedimentation and, more commonly, by filtration. The sedimentation method has a number of disadvantages. Among these are: it is ineffective when the cloud consists of extremely finely-suspended particles of sugar sand; it requires a relatively long period of time; and, during the sedimentation period, the sirup cools and must be reheated for sterilization prior to packaging. This reheating is usually accompanied by the formation of additional cloud and a darkening of the sirup.

Clarification is best accomplished by pressure or vacuum filtration which permits the use of filter aids. However, the quantity of sirup filtered at any one farm where the sirup is made is, with few exceptions, not large enough to warrant investment in pressure or vacuum filtration equipment. Therefore, most sirups are filtered by gravity, requiring only inexpensive equipment. All that is required is a relatively thick but porous filter bed that will allow rapid flow of the sirup and which will remove the suspended sugar sand. Wool felt provided a filter that met these requirements. Originally these felt filters were made in the form of a cone-shaped bag which permitted suspension of the filter over a milk can or other container. Because of the mechanical strength of the felt and the shape of the bag, additional external supports were unnecessary. The disadvantages of the bags are that they are of a fixed size (capacity) and, unless the sirup is kept constantly at maximum depth, a large portion of the filtering surface is not utilized. In addition, there is also a loss of filtering surface caused by deposition of a heavy layer of sugar sand in the apex of the cone.

To overcome these objections to the cone-shaped felt filters, flat felt filters have recently been introduced. The felt can be obtained in large sheets which can be cut to any desired size. With the flat filter, the entire filter surface is utilized continuously and does not require that the sirup be maintained at a constant depth. Distribution of the sugar sand over the entire surface area results in a thinner layer so that the filters can be used for longer periods before cleaning becomes necessary.

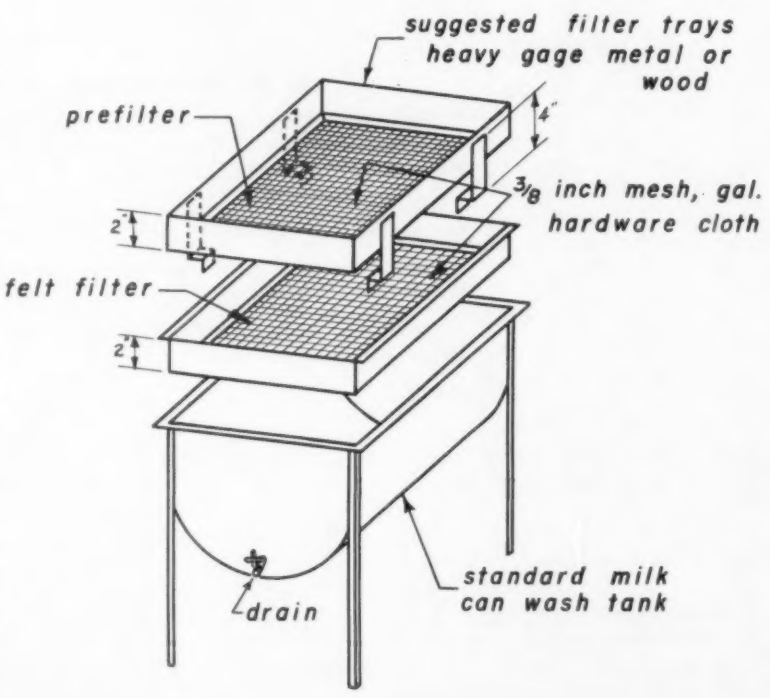

FIG. 1.—Sirup filter.

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The felt sheet can be supported in a shallow basket of hardware cloth with 2-inch walls, as shown in Figure 1. The felt is cut at least 4 inches larger than the bottom of the basket and the edges turned up 2 inches to form a shallow tray. The felt can be used two or three times longer between cleanings if the sirup is first run through a prefilter to remove a large percentage of the coarser particles of sugar sand. The prefilter should be moderately retentive and still permit a free flow of the liquid through it. Rayon press cloth makes an excellent prefilter material since it meets these requirements. The prefilter is mounted above the felt and is supported on a wire-screen basket the same size as that used for the felt. The filter racks can be built in multiple units over a common tank. As one filter becomes clogged, the raw sirup can be run onto the adjacent clean filter. This allows the first felt to drain and be cleaned. Using two or three of these units, filtration can be made into a continuous process.

Sirup filters best when it is hot, since when near its boiling temperature, its viscosity is very close to that of water. Therefore, it is desirable that the boiling sirup (217°-221° F.) be filtered immediately after being drawn from the evaporator. Also, the filtered sirup will remain hot enough (180° F. or above) to permit its being "hot packed."

Flat filters are easily cleaned of deposited sugar sand between uses. In the case of heavy deposits, the bulk of the sugar sand can be scraped from the filters and the felts washed in three successive portions of hot water. No soap or other detergent should be used. The felts can be put through a wringer, providing that only a small amount of tension is put on the rollers, and then be hung to dry.

There still remains, however, several objections to the use of wool felt filters. They are susceptible to shrinkage, which is particularly objectionable when they have been cut to size for use as flat filters. They also have a tendency to become discolored by the sirup, making it difficult to determine whether or not they are thoroughly cleaned by the washing. More important, they frequently impart a detectable "off" flavor to the first two or three lots of sirup filtered through them. This "off" flavor is not removed even by several washings of the new felt prior to use, and disappears only after several lots of sirup have been passed through the filter. This flavor-imparting characteristic may be attributed to the intrinsic properties of the wool fiber or to properties imparted to them as a result of the drastic chemical treatments involved in the manufacture of wool felt. In addition, wool felt, during storage between maple seasons, is subject to mold and moth damage unless proper preventive measures are taken.

The possibility of overcoming these objectionable features of wool felt was investigated. Felts of synthetic fibers, of approximately the same thickness and fiber characteristics as wool, are now available commercially.

These felts were first tested in the laboratory and found to warrant further testing under commercial sirup-producing conditions. These trials were made during the 1959 maple sap season.

Under commercial conditions an orlon felt was found to yield highly polished sirups even when they contained finely suspended sugar sand and they imparted no undesirable "off" flavors to the sirups, even in the first lots filtered. Water and heat did not weaken the felt or cause it to shrink. The sirups did not permanently stain the fibers, and they returned to their original white color on washing. No precautions are necessary to protect the synthetic felt from moth or mold damage.

The number of gallons of sirup which can be filtered through a given flat synthetic felt filter is, as is the case with wool felt filters, increased by use of a prefilter.

Recently a modification in the processing of sap into sirup, which permits better filtering practices, is being adopted by the maple industry. This consists of evaporating the sap to sirup in two stages. In the first stage, the sap is concentrated to a density of 50°-60° Brix in the conventional flue type evaporator. The nearly finished sirup is then transferred to a separate "finishing" pan where it is concentrated "batchwise" to standard density (65.5°-67° Brix). With this modification, the sirup can be filtered in two steps, the first filtration occurring when the "sirup" is transferred from the flue evaporator to the "finishing" pan. The second filtration occurs as the standard density sirup is withdrawn from the "finishing" pan. The hot "sirup" during the first filtration is of low density and contains the bulk of the insoluble sugar sand. While a prefilter is desirable for this first step filtration, its use can be omitted because of the rapid flow rate of this hot, thin "sirup" through the felt. Since most of the sugar sand is removed by the first filtration and only a little more is formed during the last stage of the evaporation in the "finishing" pan, only a relatively small amount of sugar sand is present in, and has to be removed from, the more viscous finished sirup. Due to the small amount of sugar sand to be removed by the second stage of filtration, a relatively large volume of sirup can be filtered through a single synthetic felt before it is clogged and has to be replaced. The small amount of sugar sand at this second stage of filtration does not make the use of a prefilter as essential as it was for the first stage of filtration.

Other synthetic felts such as nylon, dynel, etc. are being investigated for use in the filtration of maple sirup.

Mention of trade names does not imply endorsement of these products by the U. S. Department of Agriculture over other products.

A Program of Sustained Yield Forestry in the Appalachian Hardwood Region

David Rock

BEREA COLLEGE has the little-publicized distinction of having been numbered among the pioneer schools of American forestry education. In the year 1898 the Agriculture Department of the College offered a course in general forestry under the direction of S. C. Mason. At that time, some 40 years after the founding of Berea College, institutional land holdings consisted of an insignificant acreage of sand and stone quarries. Recognizing the future timber, fuel, and water needs of a growing community, the College embarked upon a program of land acquisition under the active leadership of Professor Mason. By 1910 a sizable acreage of forest land had been acquired containing not only a valuable timber reserve but also an invaluable concentration of permanent springs.

In 1907 Professor Mason prepared a comprehensive report for the proper management of the newly acquired resource, but circumstances apparently prevented the College from undertaking any specific forestry projects other than the acquisition of additional land. The valuable water resource was extensively developed for community use and the land carefully protected from fire, trespass, and grazing by a watershed fencing program of 1910.

By the time of World War I the bulk of the present 5,400 acres of forest land had been acquired. Management policies continued to revolve around the water resource with special attention paid to the problems of fire protection and tenant farming. Accurate records for the 1920's and 1930's are lacking, but it appears that only a minor volume of forest products was harvested during this extended period of custodial ownership.

At the conclusion of World War II a professional forester was added to the College faculty, the agriculture curriculum expanded to include two general forestry courses, and a program of extensive forest management initiated. A series of improvement cuttings was inaugurated in 1948 which resulted in the removal of some 1,600,000 board feet of sawtimber, 3,600 units of pulpwood, 36,000 locust and chestnut posts, and 550 ricks of fuelwood from the more accessible areas of the forest during a nine-year period. The associated marketing policies of stumpage and log sales for these forest products were unable to establish the framework for a profitable operation and failed to meet the requirements of intensive forest management. Thus, with the establishment of the federally directed Berea Forest Research Center[1] in 1955, the College authorities were prompted to reappraise the entire forestry program and initiate an economically and technically sound demonstration of timber and water management in the Applachian region.

Forest Description

Lying some 40 miles southeast of Lexington, the Berea College Forest (Fig. 1.) is situated in the so-called "Knobs Region" of eastern Kentucky's Cumberland Mountains. The "Knobs" represent the westernmost remnants of the highly dissected Cumberland Plateau area. The physiography of the forest area is characterized by a complex network of escarpment-flanked ridges and steeply sloped hollows. Average elevations within the forest range from 900 feet on the lower slopes to 1,500 feet atop the ridges. A discontinuous limestone-sandstone cliff, up to 100 feet in height, occurs at the 1,300-foot level.

The soil and site characteristics of the forest are closely associated with topographical location. Up to about the 900-foot level heavy clay soils derived from black carboniferous shales predominate. Such areas were largely cleared for agricultural purposes during the late 1800's but have now reverted to a mixed forest cover of Virginia pine, scarlet oak, and white oak.

Extending up to the 1,300-foot level is a zone of gray-shale clays whose impermeable upper stratum gives rise to a perched water table and the series of never-failing springs. Characteristic species of this soil group are yellow-poplar, white oak, red oak, black oak, ash, hickory, sugar maple, walnut, and basswood.

The limestone derived soils found in the vicinity of the 1,400-foot level are associated with the highly productive cove sites which support excellent stands of yellow-poplar on northern and eastern exposure. Occupying the ridgetops above the sandstone escarpment are light sandy soils which, in years past, supported a number of small tenant farms. Apart from the old-field stands of Virginia pine and yellow-poplar the predominant species are chestnut oak, hickory, and shortleaf pine.

The present forest consists of 5,000 acres of commercial woodland; land which is primarily de-

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[1]The author wishes to acknowledge the important role played by the Central States Forest Experiment Station and staff members of the Berea Forest Research Center in initiating interest in a formal forestry program at Berea College and in giving valuable technical guidance to the entire project.

voted to the production of sustained yields of sawtimber. It is important to note, however, that nearly one-fourth of this commercial area comprises the total watershed of the two reservoirs which supply all the domestic and industrial water used by the City of Berea (1960 population: 4,500).

As determined by the 1957 inventory based upon Bitterlich's variable plot method of cruising, the basic forest resource consisted of approximately 29 MM board feet of merchantable sawtimber. The relative distribution of this volume by forest type, species group, and size class is presented in Tables 1 and 2. The average sawtimber growth rate for the commercial forest area was found to be 200 board feet per acre per year, with a few of the heavily stocked yellow-poplar stands yielding an annual increment of 800 board feet per acre. The average basal area stocking in all size classes (4.6 inches d.b.h. and up) was found to be 66 square feet per acre. Although the inventory made no attempt to evaluate the quality of the sawtimber on a tree grade basis, it was assumed, based upon Cumberland National Forest grade recovery studies, that approximately 30 percent of the hardwood sawtimber volume would yield #1 Common or better factory grade lumber.

Regulation

For administrative purposes the forest has been divided into 12 compartments varying in size from 380 to 550 acres. The basic objective in regulating the total forest resource is to provide for a sustained annual yield of sawtimber. Operating within the framework of a 10-year cutting cycle, the initial goals of management will be to maintain the 1957 forest-wide stocking level of 6,400 board feet per acre and improve quality composition through a carefully applied system of improvement and reproduction cuttings. The establishment of long range growing stock goals will become feasible only through the application of future inventory reappraisals.

Regulation procedures are concerned exclusively with the board foot volume of the presently operable portions of the commercial forest land. Based largely upon volume per acre and accessibility considerations, it was found that 88 percent of the commercial forest acreage was currently operable, or would become so through growth during the initial ten-year period. More specifically, this amounts to an operable area of 4,400 acres supporting an estimated sawtimber volume of 28.2 MM board feet growing at the rate of 882 M board feet annually. Based upon L. R. Grosenbaugh's recently formulated allowable cut procedure[2] the total ten-year yield of the forest has been calculated to be approximately 7.9

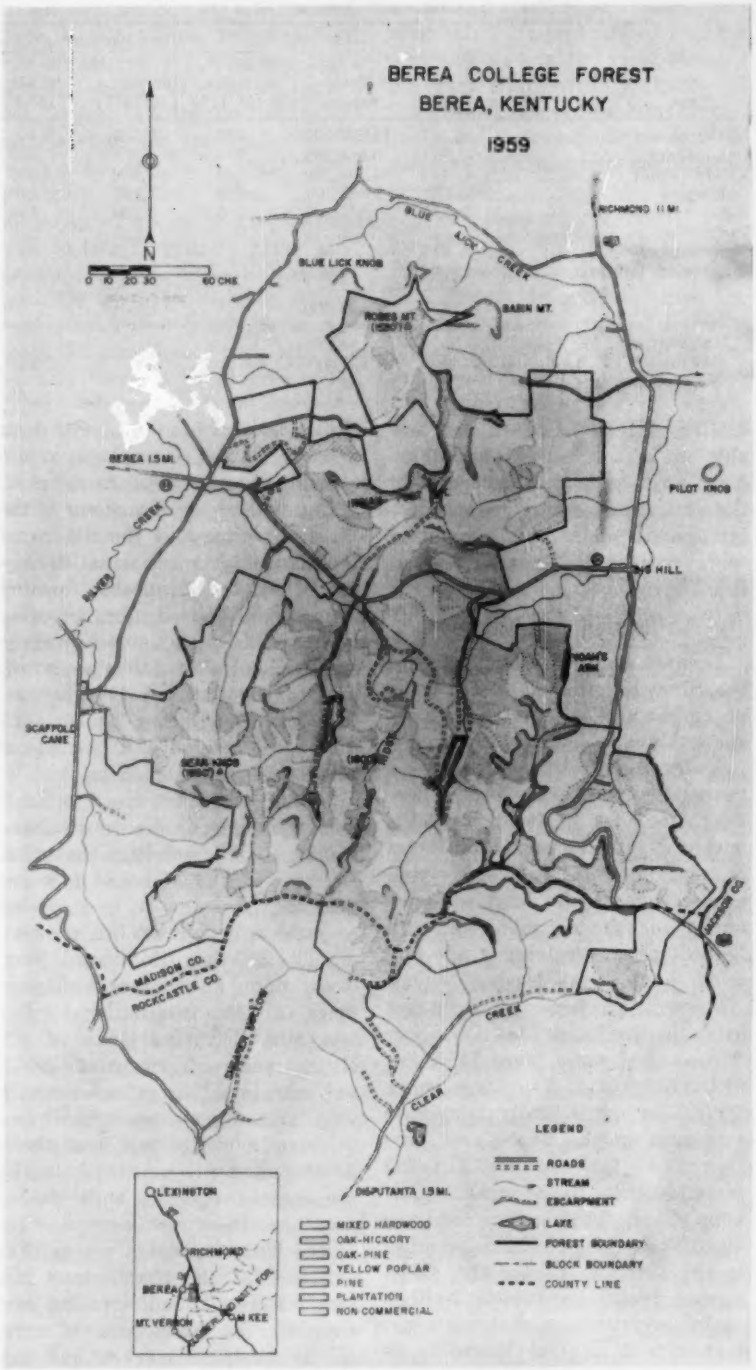

FIG. 1.—Berea College Forest, Kentucky.

TABLE 1.—AREA AND VOLUME BY TYPE

Type	Acres	Total volume[1]	Volume per acre		
			Cu. ft. poles (5″-11″)	Bd. ft. Sm. saw. (12″-17″)	Bd. ft. lg. saw. (18″+)
Mixed hardwood	2,291	15,250,000	455	4,500	2,400
Oak-hickory	1,311	6,368,000	575	3,900	900
Yellow-poplar	410	4,305,000	545	6,500	3,400
Oak—pine	770	2,685,000	862	3,100	400
Pine	111	355,000	1,568	3,200	100
Plantation	52	———	———	———	———
Noncommercial	418	———	———	———	———
Reservoirs (water)	50	———	———	———	———
	5,413	28,963,000			

[1]International ¼″ rule.
Sawtimber 12″ d.b.h. and up; pine and poplar 10″ d.b.h.
Net volume.

TABLE 2.—VOLUME DISTRIBUTION

Species	Bd. ft. volume
Yellow-poplar	7,673,000
White oak	2,846,000
Other oak[1]	7,695,000
Hickory	3,460,000
Pine	1,653,000
Sugar maple	1,480,000
Black walnut	700,000
Miscellaneous[2]	3,456,000
	28,963,000

[1]Northern red oak, southern red oak, black oak, scarlet oak, and chestnut oak.
[2]Ash, basswood, red maple, beech, elm, black gum, and buckeye.

MM board feet. In effect, an allowable cut of this amplitude will remove approximately 90 percent of the anticipated forest growth during the period and will maintain the average growing stock level at 6,400 board feet per acre.

Utilization Alternatives

Located on the eastern edge of the Bluegrass Region, Berea is by no means ideally situated with respect to available markets for such primary forest products as sawlogs, veneer logs, and pulpwood. There are a number of small sawmills within a 30-mile radius of Berea but only two are sufficiently well established to offer a dependable outlet for sawlog material, with both of these involving a one-way truck haul of at least 25 miles. An excellent veneer log market exists in the Louisville, Ky.—New Albany, Ind., area, some 115 miles to the northwest. Two large paper companies periodically purchase pulpwood in the Berea area: the Bowaters Corporation situated some 160 miles to the south in Calhoun, Tenn., buying pine, and the Mead Corporation located 159 miles to the north in Chillicothe, Ohio, buying peeled hardwood. Neither outlet constitutes a stable market inasmuch as central Kentucky is presently at the outer limit of their respective wood procurement territories.

Two specialty markets for rough forest products exist in the vicinity of Berea. A small hickory handle stock mill is located at McKee, some 25 miles to the southeast. White oak stavewood material finds a ready market at any one of the several cooperage mills in the area.

Both the physical makeup of the forest resource and the nature of the regional market situation dictate that the proposed forestry operations be based upon a sawlog economy. In such a situation three management alternatives are available to the College: (1) contractual sale of standing timber, (2) direct sale of logs, and (3) sale of processed lumber.

Under more or less optimum market conditions a system designed to sell standing timber at the rate of 790 M board feet per year may reasonably be expected to yield a net return of approximately $10 per M board feet, based upon an average stumpage price of $13 (International rule) less administration costs of $3. By net return is meant the residual margin, after expenses, available for stumpage, operational profit, investment interest, and forest development programs (excluding the cost of operator-built timber access roads—a cost accounted for in the basic stumpage price). The existence of the Cumberland National Forest 20 miles to the east supports the framework of a regional stumpage market, but it is weakly developed in the vicinity of Berea. The various contractual specifications of such timber sales nearly always fall short of creating a truly effective instrument of intensive forest management. Well-formulated stumpage sales would yield periodic income to the College, but the productive potential of the forest would be compromised to conform to the vagaries of local markets and logging operators.

A system of direct log sales would commit the College to an estimated $23,000 investment in logging equipment and would yield only an estimated $5.25 net return per M board feet on the over-all enterprise, based upon an average delivered log price of $35 (International rule) less logging and administrative costs of $29.75 (road costs treated as capital improvements). Experiences of the past nine years indicate that log sales are characterized by serious disadvantages in this region. The risks involved in handling such perishable products as sawlogs are appreciable in an area where the sawlog markets are so weakly developed. Further difficulties arise in connection with the regional popularity of the Doyle log rule and the gross discrepancies between it and the International ¼-inch rule. Log sales would permit the application of intensive forest management practices subject to a high degree of control, but the attendant economic and administrative difficulties would be very real and serious obstacles.

Lumber sales represent the highest level of utilization available to the College, with an estimated net return of $13.50 per M board feet on the annual harvest of 790 M board feet of rough air-dried lumber. This figure is based upon a lumber value of $79 less operational and sales costs of $65.50. The manufacture of such a product would require an equipment and plant investment of $51,500 (plus an average annual investment in lumber inventory of $15,000), and would result in the establishment of a processing opera-

[5]Grosenbaugh, L. R. Allowable cut as a new function of growth and diagnostic tallies. Jour. Forestry 56:727-730. 1954.

tion with a potential capacity of 2 MM board feet annually.

As soon as annual production approximated mill capacity the resultant reduction in fixed unit costs would increase the over-all net return to an estimated $27.50 per M board feet. In order that these higher net returns be realized in the shortest possible period, the 790 M board feet allowable cut from the forest should be supplemented by the purchase of logs and stumpage.

The regional demand for well-manufactured air-dried lumber is not subject to the serious market fluctuations associated with stumpage and logs. In addition to dealing directly with concentration yards and wood-using industries of the region, the forest could supply many of the annual lumber requirements of the College itself. Direct sales to regional retail markets could be realized by adding a planing mill after the operation becomes well established. The possibility of further processing the lower grades of lumber into such items as pallets, crating, industrial blocking, barn patterns, and livestock feeders and shelters should be given serious consideration. The creation of such an active forestry enterprise will make contributions to the over-all College program impossible of attainment under a policy of stumpage or log sales.

Silvicultural Considerations

Intimately associated with any regulatory attempts to sustain the annual yield of the forest is the concept of even-aged versus uneven-aged management. The extremes of either system appear unsuited to the average conditions found in the Berea College Forest. Formal regenerative cutting systems will be applied to a number of old-growth mixed hardwood stands and to those oak-pine stands which were partially cut during the past 15-year period of extensive management. A flexible form of group selection cutting will conform to the reproduction requirements of these two timber types.

The system of improvement cutting which will predominate during the initial cutting cycle will be designed to increase the proportional representation of shortleaf pine, Virginia pine, yellow-poplar, white oak, red oak, ash, and black walnut at the expense of scarlet oak, beech, hickory, and a variety of miscellaneous species.

In view of the regional forest products market situation, the majority of all cutting operations will be based upon the removal of sawlog-sized material. However, periodic opportunities to remove such roundwood products as firewood, pulpwood, and posts will materially increase the degree of silvicultural control over forest development afforded by sawtimber harvests alone.

An intensive program of timber stand improvement practices will constitute an integral part of the over-all silvicultural policy for the forest. Undesirable woody vegetation, including trees, shrubs, and vines, possessing no salable value will be girdled or poisoned—with certain allowances made for maintenance of the native wildlife habitat.

One specific objective of silvicultural policy will be to increase the stocking of pine in the oak-pine and oak-hickory type. Artificial stocking through the interplanting of shortleaf pine or white pine may be required in those areas where seed sources are inadequate for natural conversion.

Forest Developments

The harvesting program will be patterned after the mountain logging techniques employed on the Fernow Experimental Forest in West Virginia; that is, uphill power skidding of tree length material by crawler tractor and arch. The extensive network of permanent roads required by this system will be located so as to take maximum advantage of the mid-slope benches so characteristic of the Knobs area. In effect, this will result in a program of logging on the contour.

Weather conditions normally limit the logging season to a period extending from April to November, with occasional extensions into mid-January. Optimum operating conditions occur during the fall months.

The existing network of truck and tractor roads falls far short of meeting the anticipated requirements of a sustained yield forestry program. Successful application of the proposed cutting budget presupposes the systematic development of a permanent network of truck and tractor roads.

Apart from a very limited mileage of multipurpose road designed for year-round vehicular traffic, approximately 15 miles of medium-standard truck road and 60 miles of low-standard permanent tractor trails will be constructed to serve the timber access and forest development needs of the various compartments.

With the majority of the sawtimber resource occurring on valuable municipal watershed lands, timber values alone cannot dictate management policies. Fortunately, the principles of sustained yield forest management are compatible with those of sustained yield water management. The cutting operations of intensive forestry serve to maintain over-all water yields with no associated impairment of quality. All logging roads will be located so as to cause a minimum of disturbance to the natural channels of existing watercourses. Similar precautions will be observed during the felling and ground skidding operation. All log transportation activities must be carefully planned to avoid any prolonged wet weather disturbance of the permanent road system.

Ever since the abnormally dry years of 1952 and 1953 the College Forest has enjoyed a period of relative freedom from woodland fires. If this record is to be maintained through the critical periods of future dry years, particularly until such time as Madison County comes under the state fire protection program, the College must maintain its own firefighting organization during the high risk March and October fire seasons.

Present recreational usage of the forest may be classified as follows: hiking and picnicking in the vicinity of Indian Fort Mountain, occasional group camping in the Pigg Cabin area, and annual hunting for small game over the entire property. Specific allowances have been made in the proposed forestry pro-

gram for the maintenance of all such recreational values. Increased community usage should be promoted by developing adequate facilities for year-round group camping in the Pigg Cabin area. Through the construction of all-weather roads and adequate parking facilities the city reservoirs eventually should be capable of supporting a public fishing program—although on a closely regulated basis.

The potential value of the College Forest as an outdoor laboratory in applied forest research and conservation education is practically unlimited. The existence of the federally directed Berea Forest Research Center will provide the necessary stimulus and technical direction for an active program of forest management research.

In view of the commanding position held by Berea College in the fields of education and rural development in the southern Appalachian Mountains, there is a definite obligation on the part of the College to demonstrate effectively to its students and to the region as a whole the benefits resulting from the proper management of one of the region's most important natural resources—timber. The creation of an actively successful forestry enterprise founded upon the principles of intelligent resource management will constitute a highly effective medium of conservation education.

Addendum

In conclusion it is important to note that the College's planning efforts are not destined to become part of the historically poor performance record of formal management plans for small and medium-sized forest properites. In July 1959, the administration and trustees gave their formal approval to an intensive forestry program based upon the manufacture and sale of lumber. Logging activities began in September 1960, and with this end in mind some five miles of truck and tractor roads were built in a 400-acre compartment during the fall of 1959.

In June 1960, construction of an $8,000 permanent mill shed was completed. Milling operations were scheduled to commence during December 1960, and will follow a seasonal winter-summer schedule until such time as a log-buying program is developed. In order to provide a more accurate means of regulating the allowable cut for sustained yield and to create the necessary framework for a program of applied research in the management of Appalachian hardwoods, an inventory system of permanent sample plots was initiated in February 1960. The underlying purpose of all these activities is the creation of an economically and technically successful demonstration of intensive resource management.

Visiting Scientists Program Launched

The Visiting Scientists Program in forestry, sponsored by the SAF and financed by a grant from the National Science Foundation, was launched the week of January 8 with visits to the universities of Maine and New Hampshire by Professor Bruce Zobel, forest geneticist of North Carolina State College. Forty-six institutions are now participating in the program.

Notes and Observations

Silvics in 300 B.C.

Primitive man, by necessity, was forced to familiarize himself with plants. He came to know where certain plants were to be found and even classified them in a crude manner into various groups. These groups were naturally based upon qualities easily observed and understood. The application of scientific principles in group classification was much slower in developing and it was not until the era of the early Greek philosophers, the creators of natural science, that a consistent concept of nature evolved.

At least 300 years before Christ, the first written data concerning "Silvics" was recorded by Theophrastus. So outstanding were Theophrastus' contributions that he is often referred to as the Father of Botany and could appropriately be called the Father of Silvics.

Theophrastus was born in 370 B.C. at Eresos in Lesbos, and at an early age became a student of Plato. It was from Plato and later, Aristotle, that Theophrastus learned the principles of describing and classifying plants. It appears that he was the first to systematically apply these principles to the plant kingdom. He not only described all plants of the Greek countryside and those brought to him by travelers and conquerors of southern Asia, but he also dealt in some detail with the more ecological or silvical aspects of botany. Included were climate, aspect, tolerance, reproduction, and differences in habitat or site requirements.

Theophrastus was fresh and naive, and his thinking was unencumbered by dogma of any kind. His approach was largely a descriptive one and he simply recorded the things which he so keenly observed, giving little concern to the reasons for various phenomena. His logic, heavily weighted toward the side of inductive reasoning, was typical of his time.

Theophrastus was a voluminous author, being credited with more than 200 treatises covering many subjects of human interest. His principal works, in existence to this day, consist of the nine books, *Enquiry Into Plants*,[1] and the six books on the *Causes of Plants*. Because the former of these two works, particularly the first five books, could well be considered the progenitor of our present-day silvics, let us examine some of their contents.

Prior to any attempt at classifying plants, Theophrastus studied their "essential parts" and evaluated their functions. He recognized such parts as roots, stems, branches, leaves, flowers, bark, and was aware that certain plants did not possess all of these. He therefore chose trees as a standard in his discussions.

Here, perhaps, is the first written definition of a tree. It is described as "a thing which springs from the root, having knots and several branches and cannot be easily uprooted." A shrub is "a thing that rises from the root with many branches" while an undershrub has many stems as well as many branches. An herb was classified as "a thing which comes up from its roots with its leaves and has no main stem, the seed borne on the stem."

He knew the general function of the main parts of trees and had some idea of their composition. He stressed the importance of moisture and warmth in the formation of plants and distinguished between sapwood and heartwood, recognizing the existence of meristematic tissue and protoplasm. Referring to the external parts of plants, Theophrastus wrote "furthermore there are things which are even prior to these, from which they are derived—sap, fibre, veins, flesh, for these are elementary substances."

Although Theophrastus recognized many differences in plants, such as their floral organs, positions of fruits, and contrasting symmetry, his classification of them into trees, shrubs, undershrubs, and herbs, was largely on a basis of form.

He did not approve of precise definitions, stating that definitions should above all be typical; that trees cannot safely be categorized as being either deciduous or evergreen because deciduous trees may retain their leaves in certain climates.

Discussing the effect of habitation and the appearance of plants, he warned that although there are "differences of natural characters" the influence of environment upon these characters must always be considered. He also cited the two extremes of habitats for vegetation and thus divided all plants into aquatic and land plants.

He elaborated at some length on the more common differences between parts of plants. Hardness, texture, weight, straightness of grain, and strength qualities were among these differences. Height, mode of branching, and type of bark received a great deal of attention.

Confining certain remarks solely to trees, Theophrastus believed that those growing on wet sites had fewer branches than those found in drier places. He was aware that trees of the same species were influenced in their branching habits by such environmental factors as wind, insects, ice storms, and soils.

Among dioecious trees, "females" were believed to have less branches than "males." Although many other remarks were made as to the sex of plants, it was a subject somewhat obscure to Theophrastus.

Even pruning was practiced in 300 B.C. The removal of branches

[1]Theophrastus. Enquiry into plants. Harvard University Press, Cambridge, Mass.

was recognized as a means of altering the form of trees and influencing their fruiting capacity.

Spacing or density was recognized as a very important element for the control of branching. An observation on the effect of competition upon the growth habit of trees is given in the following quotation:

". . . the same trees which, when growing close together, are tall and slender, when grown farther apart become shorter and stouter . . ."

In his study of foliage, Theophrastus recorded many differences between leaves. Shape, venation, pubescence, presence or absence of spines among other differences were used in classifying plants. He also found that those trees which put forth leaves earliest in the spring often were the last to shed them in the fall. Moisture conditions were known to greatly affect the time of leaf-fall, trees on dry sites losing their leaves earliest within the same species.

There were many things which he did not know, but his knowledge was sufficient to subdivide plants into: (1) aquatic and land plants; (2) higher and lower plants, the latter being represented by fungi and algae; (3) annual and perennial plants; and (4) his classic categories of trees, herbs, and shrubs which greatly enhanced the development of further botanical knowledge.

In 300 B.C. plants were believed to have originated spontaneously and were perpetuated either by reproducing from seed, by sprouting, by grafting, or by rooting from cuttings. As a result of ancient aboricultural experience, it became evident that some trees could be propagated much easier than others. Some trees were easily rooted from cuttings, others with more difficulty, and some not at all.

Grafting and budding were practiced by the Greeks for it was known that vegetatively produced plants possessed the same characteristics as their parents. Those produced from seed often showed degenerate characteristics, the progeny differing from the parent in flavor, sweetness of fruit, and other features. Some trees were observed to show much less variability than others. Thus, in 300 B.C. genetic variability was at least recognized, and the methods used to perpetuate desired strains were no different than those of today.

In his notes on propagation and cultivation, Theophrastus recommended the selection of elite individuals, that they be taken from a soil resembling, or inferior to that in which they were to be planted. He found that climate was more important than methods of cultivation since plants transplanted under adverse climatic conditions often did not produce fruit at all.

The benefits of applying fertilizers were also appreciated 2,200 years ago. In addition, artificial pollination was practiced to a limited extent. This can be recognized from such phrases as "it is helpful to bring the male to the female; for it is the male that causes the fruit to persist and ripen."

In 300 B.C. most wild trees were believed to perpetuate themselves from seed disseminated by water, wind, and other agencies. The presence of seeds and pollen in the air was observed by some investigators and rain was credited with bringing these materials to the ground or in contact with other trees.

Theophrastus, very much interested in the time of budding of wild trees, wrote at some length on this phenomena. He found variation even among trees of the same species and little correlation between initial growth and time of fruiting. He was also aware that some trees required more than one growing season to mature their fruits.

Perhaps Theophrastus was also part-timberman and part-conservationist. He placed a great deal of emphasis upon the proper season for cutting trees to be used for lumber. Here, probably is the first mention of the "peeling season," a time so significant to the pulpwood industry.

The value of bark removal for protecting timber from insects was thoroughly recognized. He also advised that "it is clear in all cases that wood is better when the tree is in its prime than when it is quite young or has grown old. The wood of young trees being too succulent and that of old ones too full of mineral."

It is also interesting to note that wood preservation was practiced in 300 B.C. Veneers were used in making furniture, and logs were stored in water to protect them from insects and facilitate rapid seasoning of lumber.

It is doubtful if our recent use of hormone sprays for controlling vegetation would have surprised Theophrastus greatly for he wrote that ". . . destruction which oil causes is due rather to a kind of addition than to removal; for oil is hostile to all trees, and some pour it over what remains of the roots." He realized also that oil was more potent on young trees than mature ones.

One of the outstanding impressions gained from this treatise on wood utilization is the knowledge acquired by these ancient peoples of the great variability in wood structure between species, different trees of the same species, and also within each individual tree.

Summary

It is our belief that Theophrastus' works of 2,200 years ago represent the first significant step in the development of silvics. Although a great deal of information relative to the origin, geographic distribution, classification, and ecology of plants has been produced since the time of Theophrastus, the periods of greatest innovation occurred only as a result of a similar naive approach, best exemplified by Alexander von Humbolt's contribution to plant geography and Charles Darwin's theory of evolution.

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University of Massachusetts, Amherst

Pales Weevil Control with Sodium Arsenite

Recently, interest in the control of pales weevil (*Hylobius pales* Herbst) has been stimulated by managers of coniferous plantations (*4, 5*). Control of this insect has been directed toward the proper timing for replanting (*2*), or insecticide treatments of the seedlings prior to planting, and to established seedlings in cutover areas (*5*). These methods are based upon the knowledge that pales weevil populations are attracted to or will become established in fresh stumps. Therefore the seedling conifers must be protected from damage by the attracted or emerging adults.

The control method proposed herein was suggested by Dr. F. C. Craighead, Sr.[1] It simply involves the treatment of freshly cut stumps with sodium arsenite to prevent weevil establishment. The method should be of particular value to Christmas tree growers whose annual harvest and replanting provide a most suitable environment for the pales weevil. Treatment is applied at the actual time of harvest so that revisiting the site with the possibility of missing stumps is avoided. Attraction of weevils into the area is not forestalled, but they are prevented from reproducing in the host material. Much damage is avoided by precluding population buildup near young trees (*1*). The equipment, technique, and results of the stump treatment test are described below.

Scotch pine (*Pinus sylvestris* L.) Christmas trees were cut in 1958 for the first time in an experimental area located near Blain, Perry County, Pennsylvania. The harvest was made on December 8. The stumps measured 2 to 3 inches in diameter at a height of 3 inches above the ground. Thirty-seven stumps in four alternate rows were treated; every other row, with a total of 40 trees, was left as untreated checks. On December 9, about ½-oz. "Atlas D" sodium arsenite debarking compound[2] was poured on each of the frozen stumps using a 2-quart "Eagle" oil can. This amount was sufficient to cover the cut surface. Nearly a year later, November 23, 1959, 22 treated and 22 untreated stumps were dug and examined.

All the untreated stumps were damaged by pales weevil and none of the treated stumps showed pales weevil activity (Fig. 1). The poison was applied full strength and controlled all the weevils; therefore a more dilute solution may be satisfactory.

Pales weevil damage, the remains of an adult *Hylobius* (possibly *H. pales*), bark beetles (*Orthotomicus caelatus* [Eichh.]), and a flathead borer (*Chrysobothris floricola* Gory) were collected from the untreated stumps. Decay fungi (*Polyporus* prob. *tulipferae* [Schw.] Over.), and an undetermined hymenomycete were present in samples of the untreated stumps.

Oligochaetes, mites (*Rhyzoglyphus* spp.), and springtails (*Folsomia fimetaria* L.) were taken from the moist decomposed inner bark

(*Continued on page* 124)

[1]Retired chief of the former Division of Forest Insect Investigations, Bureau of Entomology and Plant Quarantine, U. S. Dept. Agric.

[2]Chipman Chemical Co., Inc., Bound Brook, New Jersey. Mention of a commercial product by the Pennsylvania Department of Forests and Waters does not imply endorsement.

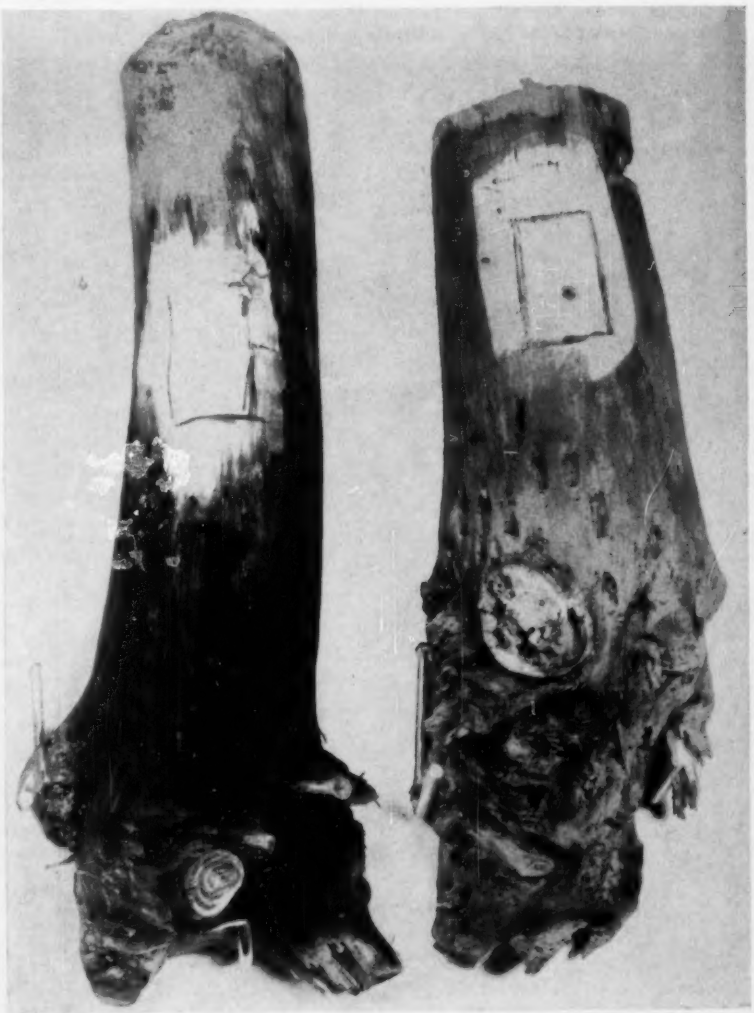

FIG. 1.—Sodium arsenite treated stump on left has no pales weevil pupal chambers. The untreated stump on the right contains many pales weevil pupal sites around the root collar.

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of the treated stumps. Ants (*Acanthomyops claviger* [Rog.]) and an undetermined earthworm species were observed adjacent to the treated stumps. Fungi were found on the treated stumps. A decay fungus (*Polyporus biennis* Fries), a red-brown stain fungus (*Cytospora pini* Desm.), a blue-gray stain fungus (*Leptographinum* spp.), and the conidial fungus, (*Fusarium spp.*) were cultured, but the wood was generally firm in contrast to the spongy texture of many of the untreated stumps.

As a debarking material, the compound contains 40 percent sodium arsenite, animal repellent, wetting agent, and a dark dye. It would be well for anyone who intends to apply arsenicals to trees to review an article by Cook on their application, hazards and safety measures (*3*).

Based upon the results of this test, "Atlas D" sodium arsenite debarking compound applied to freshly cut stumps can be expected to prevent the establishment of the pales weevil.

ACKNOWLEDGMENTS

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Mouse Damage to Forest Plantations in Southeastern Manitoba

In 1946, Littlefield, Schoomaker, and Cook[1] reported that field mice (*Microtus pennsylvanicus* Ord) had caused considerable damage to young coniferous plantations in New York. One of the species most seriously affected was Scotch pine (*Pinus sylvestris* L.). The damage occurred during the winter and consisted of the gnawing of bark on the main stem and lower lateral branches. Considerable wood was exposed and trees were often completely girdled.

In the spring of 1959, similar conditions were observed in a number of plantations established between 1946 and 1955 within and adjacent to the Sandilands Forest Reserve in southeastern Manitoba. The occurrence of mouse droppings beneath damaged trees, the presence of numerous runways and nests, and the sighting of occasional individuals indicated that the damage in Manitoba, as in New York, had been caused by field mice (*M. pennsylvanicus*). An examination of teeth marks on damaged stems verified these observations.[2]

In June 1959 several plantations were examined to determine the extent of the mouse damage. Random rows of trees were tallied throughout each plantation investigated. Trees were classified as undamaged, main stem less than one-half girdled, main stem more than one-half girdled, and main stem completely girdled. The latter category is the most significant record, because, while some of the partially girdled trees may be expected to survive, the completely girdled ones are certainly doomed. Results are shown in Table 1.

Scotch pine was most susceptible to damage, jack pine (*Pinus banksiana* Lamb.) was intermediate, and red pine (*Pinus resinosa* Ait.) and white spruce (*Picea glauca* [Moench] Voss) were undamaged. The preference of mice for Scotch pine was demonstrated in plantations 2-50, 3-55 and 1-52 which were mixed plantations, the first two of red and Scotch pine, and the third of jack pine, white spruce and Scotch pine (Table 2). Observations made in several other plan-

[1] Littlefield, E. W., W. J. Schoomaker, and David B. Cook. Field mouse damage to coniferous plantations. Jour. Forestry 44:745-749. 1946.

[2] Identification by C. H. Buckner, Forest Biology Division, Department of Forestry, Canada.

TABLE 1.—MOUSE DAMAGE IN VARIOUS PLANTATIONS IN SOUTHEASTERN MANITOBA, 1959

Plantation number	Species	Undamaged	Main stem less than one-half girdled	Main stem more than one-half girdled	Main stem completely girdled	Number of trees tallied
		Percent				
2-46[1]	scP	90	3	2	5	120
3-47	scP	95	2	1	2	200
1-48	scP	60	16	8	16	200
1-50	scP	90	5	2	3	113
2-50[2]	scP	94	4	2	0	109
2-50[3]	scP	29	15	15	41	141
1-52	scP	32	10	10	48	111
3-55	scP	14	4	4	78	87
2-50[2]	rP	100	0	0	0	69
2-50[3]	rP	100	0	0	0	79
3-55	rP	100	0	0	0	88
1-52	jP	80	9	2	9	82
3-53	jP	90	0	0	10	113
1-52	wS	100	0	0	0	64

[1] First number refers to plantation number, second to year of planting.
[2] Knoll.
[3] Depression.

tations, which were not sampled, substantiated the findings from the three mixed plantations.

Severe damage was confined to sites supporting a moderate to dense grass and shrub cover, which apparently provided good habitat conditions for mice (Fig. 1). Dominant grasses included big bluestem (*Andropogon gerardi* Vitman), bent grass (*Agrostis* spp.), wheat grass (*Agropyron subsecundum* [Link] Hitchc.), and June grass (*Koeleria cristata* [L.] Pers.). Associated shrubs included pin cherry (*Prunus pensylvanica* L.f.), saskatoon (*Amelanchier alnifolia* Nutt.) and spirea (*Spiraea alba* Du Roi). Conversely, damage was light where such a cover did not occur.

The correlation of minor vegetation density with severity of damage was pronounced in plantation 2-50. Because of better moisture conditions, a denser cover of minor vegetation occurred in depressions than on knolls, and damage was greater in the former (Table 1).

Although mice were capable of girdling even the largest trees sampled, the two oldest Scotch pine plantations were only lightly damaged. The relative sparseness of ground cover in these closed plantations apparently did not provide favorable habitat conditions for mice.

FIG. 1.—Completely girdled Scotch pine in plantation 1-48. Extent of damage permitted by depth of snow. Note heavy grass and shrub cover favorable to high mouse population.

TABLE 2.—MOUSE DAMAGE IN MIXED PLANTATIONS IN SOUTHEASTERN MANITOBA, 1959

Plantation number	Species	Percent of trees damaged
2-50	scP	43
	rP	0
1-52	scP	68
	jP	20
	wS	0
3-55	scP	86
	rP	0

Initial survival of the plantations had been between 600 and 1,300 stems per acre, and well-stocked stands were expected to develop. However, mouse damage was so severe that one Scotch pine plantation was virtually destroyed and others reduced in potential value. Because damage was greatest in the depressions, where growth was best, the reduction in value of the lightly damaged plantations is greater than indicated by the data.

Although heavy damage may occur only during occasional periods of high mouse population, the fact that plantations may be damaged until at least 13 years after planting indicates that the possibility of mouse damage is a factor which might be considered in the development of planting programs. The probability of mouse damage occurring might be appreciably reduced by confining the planting of susceptible species to sites that will support only a light shrub and grass cover. On sites that normally furnish a favorable habitat for mice, either the less palatable species could be planted or the site treated to reduce the density of the vegetative cover.

J. H. CAYFORD
and R. A. HAIG
Canada Department of Forestry, Winnipeg, Manitoba

"Forest officers are selected in a fashion that winnows out many of the men who probably lack the inherent predisposition to conform to the preformed decisions of the Forest Service, and that guarantees at least a minimum level of technical competence. Their competence is broadened and deepened by post-entry training, both in-service and outside, and by placement, transfer, and promotion policies; the methods of improving technical skill also intensify the predisposition to conform. The predisposition is strengthened by generating identification with the agency (which at the same time adds to understanding of the announced agency objectives). As a consequence, officers of the Forest Service conform to agency decisions not simply because they have to, but because they want to. And they can because they have been equipped to do so."

—From *The Forest Ranger* by Herbert Kaufman (Johns Hopkins Press).

We Present

Thomas N. Busch and the Buschmaster

Since that historic, but perhaps now forgotten, occasion when the earliest portable power saw was demonstrated to a grateful pulpwood cutter, American forestry has never seen a mechanical wonder to equal the Buschmaster, first exhibited to an astonished and curious industry in 1958. It is no exaggeration to suggest that this remarkable machine may do in time for forestry what the combine did for agriculture.

Like Cyrus McCormick who gave his name to the reaper, Thomas N. Busch has given his name—or rather he permitted it to be appropriated—to America's first multi-purpose forest management vehicle, a fair enough arrangement since he is the man who designed it.

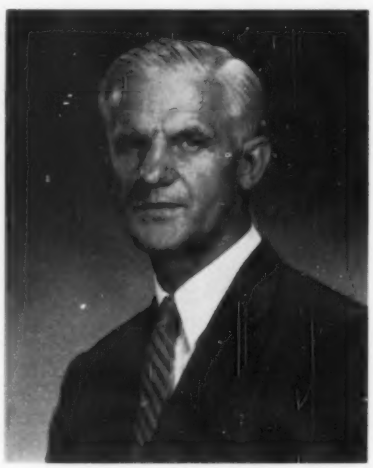
A mechanical behemoth, the Buschmaster is a specially designed unit, with a complex of parts, for a variety of forest operational uses. Basically, it is a four-wheel drive, hydraulically steered, tractor, powered by a 100-horsepower, three cylinder Diesel engine manufactured by General Motors.

The prototype was fabricated by Gar Wood Industries of Wayne, Mich. It is sold and serviced by Timberline Equipment Company of Bradley, Ill. Four machines are now in operation: in Arkansas, Georgia, Louisiana, and Virginia.

Big as it is, the unit is so fashioned that it literally bends in the middle when turning. Its roll compensation is such that even on rough terrain all four wheels maintain solid contact with the ground. Standard equipment includes a winch, a bulldozer, an underbed grader blade, a mounted fire plow, a 550-gallon water tank, and a 50-gallon tank for backfiring fluid.

No lightweight this. The bare tractor weighs 15,000 pounds; tractor and equipment together weigh 25,000 pounds; tractor, equipment, and water total 30,000 pounds.

With a turning radius of 17½ feet, steering 40° in either direction, the big "B" has a road speed of 25 miles per hour. Its over-all length is 25 feet, its height 10 feet, and its width 8 feet. It's a lot of machine.



THOMAS N. BUSCH

Perhaps the outstanding feature of the Buschmaster is its versatility. On the three occasions when I saw it in operation, it was obviously capable of performing numerous jobs in addition to its specified tasks. For example, a tree planting machine and herbicidal equipment are practical and logical auxiliary components.

Basic to the operation of the entire machine and its attachments is the tractor, which as a result of gruelling tests appears to have advantages over conventional units. Hydraulic steering permits full power output in all four wheels even when the machine is turning. It has a hinged bearing in the center together with the roll compensator that allows all four wheels to maintain firm traction even in rough terrain. As a highly mobile prime-mover, the Buschmaster with its specially designed attachments is prepared to handle not only seasonable work-loads, but the hundreds of other jobs that are impossible or difficult to schedule with single-purpose machines.

Although still undergoing modification, the fire plow, another hydraulically controlled part, is capable of heavy-duty operation even in hard clay and dense brush. It will gouge out a fire line nine to ten feet wide at a speed of two miles per hour. To be sure, other types of tractors, and fire plows can construct fire line under similar tough conditions. The lighter tractor-plow units construct fire lines of insufficient width, whereas the large combinations construct lines that are unnecessarily wide for general purposes. This unit constructs fire lines midway the two extremes, resulting in an optimum width for many situations.

The tank group is a dual-part unit, designed to do efficiently all the usual things commonly expected of water and chemicals, and a few more besides. Larger of the two is the 550-gallon water tank having a pump which operates at a pressure of 800 pounds to the square inch. The smaller is a 50-gallon tank used for backfiring fuel; its pump operates at a pressure up to 400 pounds to the square inch.

Powered by a four-cylinder, air-cooled engine, the tank group has a platform attachment with space for two men. Not only can the water nozzle and fire torch be operated

from the platform, but the fire plow or other towed equipment can be handled from it as well. But as an added convenience, the water nozzle and fire torch can with equal facility be operated as far away as 100 feet and 50 feet respectively.

In addition to suppression of wildfire, the tank group has wide utilization in controlled burning and in the application of herbicides. Use of the fog nozzle creates water fogging which smothers flames with unbelievable efficiency and dispatch. Its distribution of water is economical. Moreover, the large reservoir can be quickly refilled at a stream or pond in less than ten minutes.

With a volatile fuel, the backfire torch provides continuous or intermittent burning action with a thirty-foot reach. It is hot enough for all normal fire conditions. Thus the tank group can presoak windrows of slash and then ignite them without complete drying. Fast fire setting by the flame thrower is possible because the water reserve provides protection against the fire getting out of control. Water-soluble fire retardant chemicals may be used in the water tank whenever desired.

Although the hydraulic bulldozer blade is mainly intended for fire line construction, it of course enables the machine to move through dense brush with less difficulty than would be possible without it. Furthermore, the presence of the blade permits the Buschmaster to be employed in vegetation clearing and earthmoving. In right-of-way clearing a skilled operator can handle individual trees up to 8 inches in diameter at breast height.

Likewise, a conventional underbed grader may be operated hydraulically from two positions—straight and at a 25° angle—and may be tilted from a vertical working position to a horizontal carry position. In the maintenance of woods roads this attachment is an efficient and satisfactory tool.

Adaptability is a requisite in forestry machinery. In this respect the Buschmaster has shown outstanding capabilities. One of its primary purposes is to be an efficient prime mover of such towed

THE Buschmaster with a front-end Taylor plow, which may be adapted for fire control or site preparation prior to planting or seeding.

THE Buschmaster in action, spraying chemicals in forest tree disease control.

THE Buschmaster pulling two heavy duty wildland tree planters.

machinery as the fire plow, tow-type grader for pulling ditches, and tree planter. However, it can tow other implements normally pulled behind heavy tractors, and has been especially successful with scrapers which makes it possible to use this equipment in many forest operations as a replacement for a dump truck and loader.

Like the fictional character who could pull himself up by his own bootstraps, the Buschmaster can, if necessary, pull itself out of boggy soil. This feat is accomplished by the use of a front-mounted hydraulic winch, originally built by Gar Wood for military use. It has a line-pull capacity of 10,000 pounds and is equipped with a ½ inch cable. For miscellaneous loading and unloading and for pulling mired vehicles from soft ground, the winch is effective.

With a reasonable amount of training a qualified operator can be taught to handle the Buschmaster. A skilled bulldozer operator, for instance, could quickly learn to master it.

As regards safety, operation of the Buschmaster requires strict observance of safety rules as would be necessary with any fast moving heavy equipment or machinery. Several built-in safety factors are inherent in the unit; *i. e.*, the fact that water is available in fire control means that there is added protection for personnel and equipment as well as for extinction.

Although designed primarily for the relatively level pine region of the South, the machine is capable of performing over any similar suitable terrain, such as in the Lake States, the Piedmont, parts of the Northeast, and flat mesa country of the West. It will function, in short, on any grade where the wheels can develop traction. It is quite capable of operating in snow. Tire pressure is 25 pounds, which can be reduced to 15 pounds for operation in wet lands. During its testing the machine has been run on hilly, gullied, and brushy land. Its performance appears to be limited only by the skill of its operator.

Further uses for the machine have yet to be fully developed. A dual drawbar has been made to pull a tree planter in each wheel track. Two heavy-duty tree planters, with a three-man team, have been operated simultaneously in rough woods. Field tests with direct seeders are planned, as is the use of nutrients and protective chemicals in the water supply during planting.

In one test operation under actual field conditions, on 234 acres of cutover land with a cover of scrub oak and wire grass, 115,000 seedlings were set out in 132 hours of planting time. Even on such an unfavorablee site the estimated planting cost per acre was $8.08.

It has promise of becoming an economical tool for the application of herbicides with the mist blower, and also for the application of insecticides for spraying through seed orchards. For seed and cone collecting, the installation of an extensible ladder with "bucket" will permit an operator to work around tree tops with ease.

At this point a brief digression is in order. Most of the foregoing information was obtained from personal observation of the Buschmaster and from test reports of its operation. Curious to learn about the genesis of the machine, and how and what prompted Busch's conception of it, I got him talking about it while we were fishing together.

Parenthetically, Busch, an enthusiast as well as an optimist in all that he undertakes, is keen on fishing. Although an ardent angler, he is somewhat less skilled at the art than he thinks he is. On the other hand, he is a lucky fisherman, which may be better than being skilled.

By way of introduction, Busch, now 56, is chief of operations for the Woodlands Department of International Paper Company's Southern Kraft Division at Mobile, Alabama.

He was born in Chicago. Following completion of high school, he attended Menominee Agricultural School for two years.

After some experience in surveying and timber cruising for a logging company in Michigan, he was seasonally employed in 1928 by the U. S. Forest Service, subsequently qualifying for permanent employment under civil service. From fire dispatcher in Florida, he advanced to district ranger and assistant supervisor. For a period during 1930-1931, he was assigned to naval stores research in Florida and Georgia for the Southern Forest Experiment Station. While on this detail he devised the Busch scribe for cutting turpentine faces. In 1936 he became assistant supervisor of the Ouachita National Forest in Arkansas.

An indefatigable student of technical bulletins and textbooks on

forestry, he sought all the experience he could get under the supervision of professional foresters. In recommending Busch for membership in the Society of American Foresters, the director of the Southern Station wrote that "he has applied himself to study of the underlying facts on which the practice of forestry is based, and has succeeded in advancing in technical forestry work, even exceeding many forestry school graduates in his age-class."

While employed by the Forest Service, he was routinely engaged in the usual gamut of fire control activities and the general run of national forest administration. After going with International Paper Company in 1941, he encountered similar management problems that are characteristic of industrial forest administration.

As far back as 1929, he applied his interest in mechanical engineering to the perplexing problem of forest fire control in an attempt to improve the performance of fire plows, fire trucks, and other equipment and gadgets. During the ensuing years he experienced a certain sense of frustration in that his efforts were largely those of improvisation. That is to say, he had to devise improvements on trucks, tractors, and other vehicles that had been originally designed for quite different purposes—for agriculture, construction, highway transport, and the like. Somewhat bitterly, he once commented that the forester has always had to compromise on the acquisition and application of machinery and equipment in forest management.

Another wry comment of his—admittedly one not without justification—is that some professional foresters are so conscious of the cost of a new machine to perform a needed service that they are willing to accept an inferior article, not wholly adequate for the job, provided the cost is within reason, in their estimation. On this subject Busch becomes caustic. He is impatient with foresters who "know the price of everything and the value of nothing." This spurious thinking, he maintains, lowers the profession.

Why shouldn't foresters, he demands, have modern, efficient tools and equipment designed to help grow and produce more wood fiber per acre cheaper, better, and faster than has been done in the past? If the profession can convincingly demonstrate that it can do this, which he believes that it can, foresters should be able to write their own tickets in terms of managerial responsibilities, salaries, and executive status, both in public and private employment.

Another credo of his is so simple in its logic that one would assume that it is universally accepted. Yet it is not. It might be expressed as Busch's Law: a $500 machine that loses money is more expensive than a $1,000 machine that makes money!

After many years of experience with foresters, with trees, and with public and corporate policy, Busch has come to the realization that foresters have been too timid in their requests for money to purchase machinery and equipment adequate to the job, and too apologetic for lack of notable advances in growing and marketing trees. If from all this, the reader may infer that Busch is an original thinker, a practical forester who speaks his mind, he will be right.

According to Busch, the Buschmaster was designed as a forest management machine to facilitate the task of tree farming with the same objective that machines have been designed for agriculture. Fundamentally, it is intended to stand up under rugged multi-purpose operation. He feels that it is a break through the barrier of general resistance to a special forest management tool.

He cites certain resistance to the machine because of cost. At present the Buschmaster is a custom made job, costing about $32,000. It will remain a custom built unit until it can be fabricated on an assembly-line basis. With quantity production the machine and components would be price competitive.

The fact that the machine has been designed to perform a variety of services, and that the very nature of its diversification was intended to broaden its usefulness, has led to a somewhat illogical criticism that it is a Jack-of-all-trades and master of none. Actually, its intent was not to compete with single-purpose equipment. The machine is designed to operate on a year-round basis, doing the numerous different jobs which are characteristic of the seasonal activities of a managed forest property but which do not warrant a capital outlay for expensive special duty equipment.

Busch is frank to admit that the machine is incapable of negotiating rocky, mountainous, 60-percent slopes, and that it cannot operate cross-wise on 40-percent grades. But he believes, and any forester familiar with America's diverse cover types will agree, that there are vast areas that have suitable terrain on which hundreds of the machines can function with optimum efficiency. An efficient and economical ratio, he believes, would be one Buschmaster on a 40,000-acre managed forest.

On the positive side—and Busch is a particularly positive man—he designates those jobs that the unit can do as well or better than some single-purpose machines. Busch speaking: "For example, it can move more soil per hour greater distances than a crawler tractor of equivalent horse power. It can move water at greater speeds in off-the-road applications than any crawler can move under its own power. It can plow fire lines of the same width, at the same speed, as any crawler tractor of the same weight and horsepower. It can plant as many seedlings or tree seeds as any crawler tractor on the market. It can maintain a dirt or gravel road surface faster and cheaper than any crawler tractor on the market. It can be used more efficiently for off-the-road herbicide applications than any known method available today."

It does not take a mechanical engineer to understand that when a single prototype shows these capabilities, future improvements should make subsequent machines even more versatile. Busch readily admits that the machine will be improved with use and experience.

"The main thing," he insists, "is to have a machine in existence that can be improved."

As one might suppose, the Buschmaster is only one of a number of things Busch has designed, developed, or improved during his career. Last May the Busch combine, International Paper's prototype harvester, made its debut before 400 members of the Society of American Foresters meeting in Alexandria, Louisiana.

On being driven up to a pine tree, the harvester sheared it off at ground level, leaving no stump, picked it up, pulled it through a delimbing device, and simultaneously cut it into 63-inch sticks—all in less than two minutes. But that's not all. Catching the sticks in an attached cradle, it bound them, a cord at a time, and deposited them in a vertical bundle for another machine to pick up and load on a trailer.

The urge to describe and illustrate this harvester is almost irresistible, but that is another story.

HENRY CLEPPER

Roster of U. S. Foresters in the International Cooperation Administration, January, 1961[1]

Forestry Advisers—General

BANKS, WAYNE G.	Laos
BECKER, MAXWELL E.	Chile
BEDARD, PAUL	Washington, D.C.
BEVERIDGE, WILSON M.	Korea
DUGGAN, WILLIAM E.	Paraguay
HARDEE, JAY H.	Haiti
HUGHES, BENNETT O.	Colombia
KERNAN, HENRY S.	Spain
KIRKHAM, DAYTON	Libya
KRAEBEL, CHARLES J.	Taiwan
MARTIN, HUGH E.	Somali Republic
PARK, BARRY C.	Tunisia
PATTON, OSCAR M.	Afghanistan
SANDS, WALDO M.	Iran
SMITH, EARLE E.	Peru
SPAUR, GEORGE	Turkey
ZEHNGRAFF, PAUL J.	Philippines

Forestry Advisers—Management

BENDER, WALTER L.	Colombia
HAINES, HARRY C.	Nicaragua
HOLSOE, TORKEL	Chile
KEE, DAVID N.	Pakistan

Forestry Advisers—Silviculture

SVENDBY, CLARENCE	Colombia
WHITE, JAMES A.	Liberia

Forestry Advisers—Utilization

BAREFOOT, ALDUS C.	Pakistan
VOGEL, FREDERICK H.	Turkey
WALLIN, WALTER B.	Pakistan
WITHEROW, BOYD M.	Liberia

Forestry Advisers—Survey

ASTLE, WALTER S.	Cambodia
CHOATE, GROVER A.	Cambodia
JAMES, CORLAND L.	Cambodia
NOUSIANEN, ARNE L.	Cambodia
QUILLINAN, ADRIAN R.	Cambodia
WILLIAMS, ALVA B.	Cambodia

Range Management Advisers

ABERCROMBIE, FRANK	Somali Republic
BOMBERGER, ELON	Iran
CONNELLY, HOY C.	Peru
KLEMME, MARVIN	Nigeria
MAST, PAUL B.	Libya
SHORT, LAURENCE	Turkey
WIXON, CALVIN	Sudan

[1]The list does not include short term consultants.

Points of View

Forestry Education in the Next Decade[1]

I should like to discuss forestry education in the next decade against a broad background, not limiting it to the Pacific Northwest Region, because our profession has not been provincial even though forest regions are distinct. I should like to consider the tasks American forestry will confront, the people needed to do the job, and finally the education they must have.

First let me run over some of the characteristics of forestry. Forestry is essentially, in academic terms, a compound of economics, engineering, and biology applied to lands capable of supporting trees as the dominant vegetation. The nature of forest resources tends to confer advantages on large-scale as opposed to small-unit management of lands. But, despite ownership status or size of holdings, forest lands are, and will doubtless continue to be the proper subject of strong public interest. Americans have gone on record as favoring education rather than coercion in protecting the public interest in all types of forest land. The long-term nature of forest management requires more than average stability in ownership, policy, and financing. Finally, our forest products industries are characterized by a closer association between raw material production and conversion than is found in many other industries.

These comments by no means completely characterize forestry, but they do suggest the major areas with which forestry education must be concerned. This is no mean territory.

The Task Facing Us

Now, to sketch the tasks American forestry must take up in the next few years. In the narrowest sense, we must furnish a growing population with a greater volume of goods and services from a shrinking land base. This, in itself, is sufficient challenge to us as technicians. But our assignment is broader than this. We shall not be meeting our professional obligations if we merely take orders for certain quantities of goods and services. We must also advise our clients as to priorities and quantities; we must do some of the decision-making involved in land use economics. As Henry Vaux put it at the 1959 annual meeting of our Society in San Francisco: "If the forestry profession does not supply this background and the technical judgments related to it, to whom will the public look for guidance . . . ?" Our recent experience in local land use controversies suggests that the public will be offered guidance by persons less than fully qualified to give it.

We face these tasks in land management at a time when advances in forestry are forcing specialization of such fields as forest recreation, watershed, range and wildlife management as well as specialization within the fields of forest production, protection, and utilization. This specialization can make our various land management activities more effective, but it presents a problem of balancing and coordination which will not diminish and which we must not permit to weaken our position of leadership.

Our guidance to the public (and the public, in this sense, includes all employers of foresters) must take the form of education directed toward the end of *informed* concern for balanced land use.

Finally, we should remember that, as a member of a world community, our nation must be prepared to exchange land management knowledge with others. An important part of our professional activities will be in overseas study and assistance. Is it too visionary to predict a time when our individual national service obligations may not be restricted to military service, but instead include overseas duty in the field of our professional competence?

The People to do the Work

I launch into this topic without benefit of recent statistical information on forestry students. I have no reason, however, to believe that some of the findings of Graves and Guise in the 1932 SAF study of forest education are invalid today. Graves and Guise reported that 57 percent of forestry graduates had chosen forestry as a college curriculum because of the career appeal of forestry, whereas a comparable study of engineers gave a figure of 29 percent. I think it is still true that the idea of forestry, however accurately it may be formulated in the minds of prospective forestry students, is strongly motivating. This may be a great asset to our profession, if carefully exploited.

Graves and Guise reported another finding not so encouraging. In a study of colleges and universities where forestry was taught, forestry students ranked below the all-college median in intelligence test scores in nine out of 11 institutions, even with the median in one, and above the median in one. I suspect this finding may still have some validity, for I have recently learned of one university where, last year, high school grade point average of entering freshmen placed forestry seventh in a total of nine colleges.

Some of the approaches to recruiting which have come to my attention present little in the way of intellectual challenge to prospective students. Certainly a strong physique and a pleasant disposition are no mean assets to a forester—or to anyone else. Yet we should never, in seeking to recruit the new generations of our

[1]Presented at the Annual Meeting, Puget Sound Section, SAF, May 13, 1960, Port Angeles, Wash.

profession, lose sight of the fact that no one in our demanding work has ever had too much capacity and that few have nearly enough.

If we present the career of forestry with emphasis on monetary returns, we are at once patently ridiculous and at the same time selling short a calling which presents intellectual challenges and has professional attributes to a degree not exceeded by medicine, law, education, or engineering.

We have one asset in this regard which was denied to earlier foresters, for theirs was a new profession. Just as there is a high incidence of teachers among the children of teachers, so we are beginning to see second and third generation foresters. This augurs well for a profession which requires firm dedication.

I believe our profession will be showing signs of maturity when it can count a larger representation of minority groups and women in its ranks.

The Education Foresters Must Have

Since this is not a discussion among specialists in forestry education, I believe a detailed consideration of curricula would be out of place. Moreover, I should not be competent to present such material. I believe, however, we are fully as competent as the specialists to discuss the principles and goals of the education of foresters.

From this point on, I shall be stating my own strong prejudices. These are purely personal, and carry no authority. Nevertheless, I hope some of them will recommend themselves.

The education of foresters cannot be discussed realistically outside the context of our whole educational effort. If the pervading philosophy of the educational system is anti-intellectual, we can be sure our foresters will have slight respect for intellect. Therefore, we are all concerned in the current debates about American educational philosophy. Some of our schools of education would, if they could, reduce subject matter to an inferior status. Fortunately, however, teachers cannot be insulated from life, and cannot be prevented from thinking. Therefore, a respect for knowledge is likely to prevail. I maintain we would do well to nourish it.

Our most immediate concern with the general educational system is with the high schools, for many of the handicaps against which our schools of forestry struggle could have been avoided if our secondary educational system had been permitted to do a better job. There are several well-drawn blue prints for American secondary education. One which I favor is Conant's idea of the comprehensive high school, which is large enough to offer instruction up to the capacities of students with widely varying abilities. The high school years are too crucial to be squandered in schools staffed with six or eight teachers.

The junior college can be used to improve materially the education of foresters. The two-year junior college curriculum raises the question of academic subprofessional training in forestry. This is a controversial topic, but I must express my conviction that the professional practice of forestry in this country cannot fail to advance if our professionally trained foresters are assisted by well-trained subprofessionals or ranger school graduates. There are some aspects of the medical profession which I hope foresters will not imitate. Nevertheless, consider the waste of talent and training which would be involved if physicians drove ambulances, rushed bedpans, took blood samples, and maintained hospital records. What kind of physicians would be content to do those jobs? If we want foresters to be employed as professionals, we must see to it that there are available trained subprofessional people to do the subprofessional work, much of which is now done by foresters. We cannot afford the nice-Nelly attitude that there is something degrading about the term subprofessional, nor can we afford to give real professional training to people who will not be in a position to use it.

Just as we must recognize levels in the practice of forestry, we must learn how to deal with the problems posed by specialization. The specialist is often the proper target of satire, but the very essence of mature social, economic, or more basically, biological organization is the division of labor. If our forestry is to advance, the advances will be made possible by specialists. So we have the problem of breadth versus depth in the education of foresters. Again I suggest we look at the medical profession, more as a warning than as an ideal. I am convinced that the complexity and importance of high quality practice are no less in forestry than in medicine. When forestry practice approaches maturity, it will require no less education in depth than does the practice of medicine. Perhaps we can avoid developing an educational monster which might price professional forestry out of the market.

What are the solutions to this problem of depth and breadth? The only one that appeals to me is to ask our forestry schools not to try to teach their students everything they will need to know, but rather to train them so that their education will continue actively throughout their professional lives. Professional education is an intellectual exercise; it is not vocational training. It furnishes a foundation on which to build; it does not turn out finished products. We may well ask whether forestry education really advanced when the schools stopped cramming students for the old subject matter junior forester examination and turned their efforts toward vocational training for industrial employment. We are all familiar with the feeling of frustration and boredom which overtakes many seniors in forestry schools. Some of this is attributed to a wish for personal and economic independence, but I believe much of it stems from awareness of educational opportunities being dissipated by an overvocationalized curriculum

Employers themselves can do a much better job of vocational training than universities, which were not designed for this purpose. The jobs at which the universities have no rival are to inculcate good intellectual habits in reading and writing and to instruct in the hu-

manities, including the basic sciences. If the professional school can climax this with a few carefully chosen courses, the graduates should be equipped to grow into men who are looked to for the basic decisions in forest land management. My favorite philosopher in forestry education has said, "We don't care so much how our graduates perform when they leave school as when they have been out 15 years."

I have hesitated to use the term liberal arts because this seems to set up an antithesis between forestry and its scientific basis on one hand and the liberal arts on the other. The purpose of instruction in the liberal arts is to make the students keenly aware of what goes on about them across a front as broad as life itself, and to give them the habits and aptitudes to enable them to grow in the directions they choose. This purpose cannot conflict with professional education; indeed it makes it possible. Nevertheless, the purposes of liberal education cannot be served effectively either by releasing the students for a few hours from a highly vocationalized curriculum or by allowing members of the liberal arts faculties to infest the forestry building from time to time. The important emphasis is not on subject matters or the names of courses, but on attitudes and backgrounds of the teachers.

To repeat, I believe our goal in education of foresters should be to turn out graduates who will be uneasy unless they are continually at work broadening and deepening their education. Can we judge the effectiveness of our forestry education by what we see on foresters' book shelves and coffee tables? Too often these are old textbooks and the *Reader's Digest*. Are not the common criticisms of the JOURNAL OF FORESTRY as "too technical," equally criticisms of its subscribers?

Although I have suggested the danger that professional education can become too expensive, I believe we are far from this position in forestry education. Forestry education, in my opinion, costs both the public and the foresters far too little in time and money today. In the long run, we get what we pay for, and the profession and the public could be getting substantially greater returns from increased investments in forestry education. We owe it to ourselves as a profession, and to our clients —the public and our employers— to work strenuously to raise the quality of forestry education in the coming decade.

JOHN W. DUFFIELD
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How Far Shall We Go With Accrediting?

The recent action of the Council on the subject of the Civil Service Commission's junior professional examination for foresters has prompted me to voice my disapproval. It appears that the subject of accreditation has become an obsession with some groups and individuals in our organization. No one can deny the desirability of an accreditation program whose aim it is to improve the over-all standards of forestry education. However, a person can take issue when the original objectives of accreditation are modified to include the licensing of foresters. If the request by the Council's Committee on Civil Service, as outlined in Society Affairs[1] in the JOURNAL OF FORESTRY, October 1960 had been accepted by the Civil Service Commission, the effect would have been equivalent to the licensing of all graduates of accredited institutions for federal employment, while at the same time prohibiting the consideration of even the most distinguished graduates of nonaccredited schools. Fortunately, the Civil Service Commission had the foresight to objectively appraise this recommendation and reject it in full.

The reply to the request by the Council from C. Mansel Keene, chief of the Standards Division, expressed an interesting observation on the comparative quality of graduates from accredited and nonaccredited schools. Mr. Keene stated: "Our experience has been that the better students from such schools[2] will compare favorably with the better students from professionally accredited schools and that they are, in fact, better trained than the poorer students from the professionally accredited schools." It should embarrass us that it took an outsider to objectively evaluate the situation and call it to our attention. Surely there are many foresters who share Mr. Keene's opinion, but have been too complacent or lacked the intestinal fortitude to outwardly express themselves.

It is true that there are many so-called "forestry schools" that lack the staff, facilities, and budget to successfully teach forestry, but on the other hand there are also forestry schools of long standing with qualified professors, satisfactory facilities but lack, to some degree, a portion of the "ginger bread" required by our accrediting standards. I submit to the membership of the Society that a large portion of the graduates of the better nonaccredited schools are comparable and can successfully compete professionally with graduates of accredited schools. We should not indiscriminately brand each person as superior or inferior merely on the basis of the school attended, but on his individual merits as well.

I repeat that I fully support the original basis for accreditation of forestry schools, but I also feel very strongly that accrediting should stop at the portals of the forestry school and not be carried as a blight by the individual throughout his professional career. As an organization, the Society should stop and contemplate the entire subject of accreditation and decide how far we should go.

JAMES W. CURLIN
Baton Rouge, La.

[1]Civil Service Commission explains J.F. examination. Jour. Forestry 58:837-839. 1960.

[2]Author's note: In Mr. Keene's original statement the schools he referred to at this point were those not professionally accredited.

The Junior College and Forestry Education

The September 1960 JOURNAL OF FORESTRY carried an article,[1] in which the authors stated that until recently residence training in vocational-technical skills had been limited to the New York and Florida State Ranger Schools. Paul Smith's College has been offering such instruction since 1946. Schools in California and Massachusetts are also offering such instruction.

Paul Smith's College is a private junior college. The number of junior colleges has increased steadily since World War II with the greatest increase in the number of state and community colleges. Many of these collegs offer terminal courses in professional fields that are designed to turn out technicians who will work under professional guidance. I understand that this is a practice in forestry education in Sweden.

The men taking this terminal training are equal in capability to men taking preprofessional courses. In general, they have a specific goal in mind and some are more limited financially. The terminal training frequently inspires a desire for more education. These men often work for a period and then complete professional training. In several fields their technical competence is sufficient so that with self-education, common sense, and an ability to work with others they can move to responsible jobs. This is particularly true in logging and sawmilling.

Paul Smith's College was chartered and grants associate degrees in Arts and Applied Science under the authority of the University of the State of New York, the sole legal authority within the state. So far as I know, the Society of American Foresters has made no attempt to accredit junior colleges which offer forestry instruction. Paul Smith's College offers preprofessional and terminal courses in forestry in addition to other curricula. The faculty of 23 includes ten professional foresters with a total of 21 degrees. The facilities include a sawmill, planing mill, a 16,000-acre forest around the school, and an additional endowment of 25,000 acres of forest within a radius of 40 miles. The library has over 90 percent of the Society checklist for four-year schools except in the fields of range management, pulp and paper technology, and foreign language references. The student body of 500 includes 250 in the forestry department.

Both terminal and preprofessional programs must conform to the requirements for the Associate of Applied Science degree as set forth by the State of New York. These total 64 semester hours, plus physical education, including six hours of each of the following: English, mathematics, and social studies. We require 79 semester hours in our terminal program, which is designed to fit men for the wood-using industries. The preprofessional program must prepare men for transfer to senior colleges. Unfortunately, there is considerable variation in the freshman-sophomore years between senior colleges. So we concentrate on basic subjects with only four technical subjects included in the normal schedule.

The junior college is an American development. It places emphasis on student instruction rather than research participation, and fills a particular need in our expanding education picture. Perhaps we foresters should examine more carefully the relationship between the junior college and our profession.

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Paul Smith's College, N. Y.

[1] Stoddard, Charles H., and Charles G. Geltz. Technical training for nonprofessional field personnel in forestry and conservation. Jour. Forestry 58:726-727. 1960.

Timber Marking: Professional Procedure or Subprofessional Job?

Apparently we have at least two divergent schools of thought about who should mark timber. It was encouraging to see even the small mention recently made of this most basic forestry function in the JOURNAL. I wonder if anyone else noticed that two opposing "Points of View" were rather inadvertently presented in succeeding issues (June and July) concerning the status of timber marking? Leon Minckler,[1] in the June issue, asked if timber marking is a professional forester's job and concluded quite strongly that it is. Then Archie Patterson[2] stated in the July issue, "... many foresters do *subprofessional work*" (italics mine) and referred to timber marking as an example. The fact that the latter statement was not in answer to the previous letter indicates that it was made as a foregone conclusion rather than just for the sake of argument.

It would be interesting to see the results of a ballot of the Society on whether timber marking is or is not a professional's job. I suspect that such a ballot would be met either with profound disinterest, judging from the dearth of literature on the subject, or that the majority of professionals would vote it a subprofessional job if for no other reason than that present techniques make it a messy or laborious job, not in keeping with the popular conception of a professional's duties.

But the underlying problem concerning timber marking today is not just who should do it; rather it is the seeming unwillingness of the profession to recognize the marking operation for what it is—the embodiment of forestry—and really come to grips with the details of its application.

It should be clear, of course, that by timber marking, I mean the ap-

[1] Minckler, Leon S. Is timber marking a professional job? Jour. Forestry 58: 490. 1960.

[2] Patterson, Archie E. As a matter of information. Jour. Forestry 58:568. 1960.

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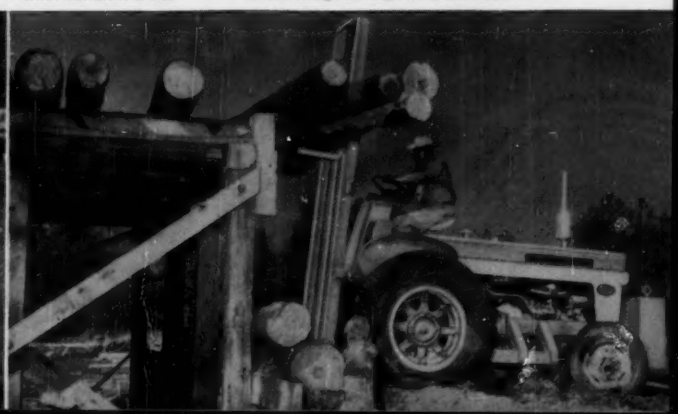

plication of the individual tree or small group selection system where the marker must make a choice based on something more than size or species. And this silvicultural system has been accepted for some time as the ideal method of regenerating several important and extensive forest types, one of them being the northern hardwood type. Now, the literature covering this silvicultural system is quite extensive and any forester can generally describe it, and most strongly advocate it. Yet, take a particular stand suitable for selective treatment and present it to a group of foresters to mark for a given set of objectives and the results, depending somewhat on the stand or group, will range from only fair consensus to wide disagreement. Some agreement is usual for the over-all stand, but when individual trees are considered. . .! Anyone who has had to mark such a stand for inspection by a Chapter meeting, for example, knows with hopeless certainty that, no matter what trees he marks, he will get an argument. In fact I am sure that many foresters feel that more heat is generated than is warranted for the feeble illumination obtained, and shy away from such critiques. And that is not a healthy situation.

The trouble is that practically nothing has been done to bring order into the field application of the selection system and if this system is ever going to be anything more concrete than a textbook phrase and a few sample plots, then some fairly accurate procedures for applying it in the field, in quantity, must be developed. As it stands now this form of timber marking is largely an art and each forester (or nonforester, as the case may be) reacts as an artist, spreading his paint as he interprets the subject.

Mr. Minckler stated that there is a steady demand for simple guides for use by nonprofessional markers; but the professional needs guides too, and I mean something more than spacing rules, tree quality classes, and the rather hazy concept of the application of "all biologic and economic factors." The forests we are dealing with are not simple so we should not expect to find workable guides which are outstanding for their simplicity. It is not simple to draw a deed correctly or perform a successful appendectomy or build a structurally sound bridge; and forestry cannot lay a very strong claim to professional stature if the central problem of guiding a forest toward a desired stand structure is considered simple.

Some may argue that the time is not yet when we can begin to consider stand structure goals in selection or uneven-aged management, and in certain parts of the country or in some stands everywhere this may be true, but we are beginning to get empirical data, at least in the Northeast and the Lake States, on what we should aim for in the northern hardwood type, and there are, just as certainly, many stands where this data would be of real benefit if applied now. The question is; how to apply it on anything more than an experimental plot? The bulletins which set forth the data on desirable stand structures, while they may be referred to as "marking guides," do not give the mechanics of how a stand of 120 square feet of basal area per acre was marked to leave 70 square feet, for example, and I doubt that the method used would be rapid enough for production marking anyway.

So, not being in a position to do exhaustive research, and failing to find anything else written on the subject, I have laid out my own set of marking guides and applied them to selected stands. I do not yet have the data on the "leave" stands, but I will be glad to set it forth if there is interest.

KERMIT E. REMELE
Ticonderoga, N. Y.

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Book Reviews

Gifford Pinchot, Forester-Politician

By M. Nelson McGeary. 481 pp. Illus. Princeton University Press, Princeton, N. J. 1960. $8.50.

From time to time one reads among the reviews of current literature that the biography of a famous man is a definitive biography. If meticulous documentation, well-selected detail, and an obvious effort to record the less admirable as well as the highly creditable moments in the career of a remarkable man are the principal ingredients in such a biography, then *Gifford Pinchot, Forester-Politician* by M. Nelson McGeary, is indeed definitive.

This is a full-length account of Mr. Pinchot's family background, youth, and 56-year career as forester, conservationist, and politician. Born in 1865 into a family of wealth, "GP" was no Horatio Alger here; except late in life (after 1929) he was never prevented by lack of personal wealth from doing the things he most wanted to, such as contribute to worthy causes or finance his own political campaigns. No one could have assumed a finer attitude toward his inheritance: "My own money came from unearned increment on land in New York held by my grandfather, who willed the money, not the land, to me. Having got my wages in advance in that way, I am now trying to work them out."

In a brief review of this book it is impossible to do more than enumerate the major activities of an incredibly active man: GP's professional training in France, Germany, and Switzerland; his professional work, in the 1890's, for George W. Vanderbilt on the latter's Biltmore estate in the mountains of North Carolina; his secretaryship of the National Forest Commission which resulted in President Cleveland's adding 21 million acres of the public domain to the "Forest Reserves," more than doubling their area; his survey of the reserves in 1897 for the Interior Department and his proposal of a forest service to administer them; his acceptance in 1898 of the headship of the Division of Forestry in the Department of Agriculture, under Secretary James Wilson; his participation in the establishment, through the generosity of two generations of the Pinchot family, of the Yale School of Forestry; his long and successful fight to enlarge the Division of Forestry, and, with the help of President Theodore Roosevelt, to obtain the transfer of the forest reserves (soon to be named national forests) to the Department of Agriculture and its newly designated Forest Service; his close association with "TR" in pushing not only forestry, but regulation of water power, and eventually "conservation of natural resources;" his spectacular struggle over public coal lands in Alaska with Secretary of the Interior Ballinger, and Pinchot's self-engineered dismissal from government service by President Taft in 1910 ("victory in defeat," as McGeary puts it); his participation in the Progressive ("Bull Moose") Party; his organization and activating of the National Conservation Association (1909-1923); his first and unsuccessful campaign (in 1914) for the United States Senate from Pennsylvania; his service as Secretary of Forests and Waters in Pennsylvania, 1920-1922; his governorship of Pennsylvania, first in 1923-1927, and again in 1931-1935.

The biography, however, is more than a recital of the crowding events of a busy life. It is a vivid picture of a man confronting his times. Pinchot's youthful background was that of wealth and Victorian complacency. He took advantage of the first to obtain both an academic education of immense value to him in his contacts with men as diverse as Theodore Roosevelt and John L. Lewis, and a professional education which gave him as a trained forester the proud confidence that has sustained many of our profession on lonely jobs and amid discouraging circumstances. Aided by wise parents, he never accepted the complacency. No sooner had he undertaken to apply to the national forests the concepts of forest management he had learned in Europe than he countered "the strong-arm methods and deliberate cheating employed by some of the 'vested interests'." From this period dated his championship of the underdog, and (again in McGeary's words) his "difficulty in believing that any man who accumulated great wealth could do so without oppressing some of his fellow men."

In spite of an unquestioning idealism, and a confidence sometimes bordering on arrogance in his own ability to discern the right and to make it prevail, Mr. Pinchot was a realist. He was never more in need of realism than when he plunged into politics. Pennsylvania foresters, who complain that Governor Pinchot apparently made no determined effort to overcome by law the notorious spoils system from which many devoted foresters had for years suffered, forget that Pinchot was probably never in a position to demand a civil service law from a legislature which to this day has never passed such a bill. Passage of the administrative code of 1923 and Pinchot's compelling the Republican State Committee in 1922 to give up "its lucrative custom of assessing state employees for campaign contributions" were perhaps as far as a governor could go who owed his election more to factional struggles within his own party

than to any widespread ardor for good government.

Gifford Pinchot, Forester-Politician is good reading for all foresters. It puts in perspective for many of us the early struggles of our profession not only against indifference to our "theories," but also against virulent attack by powerful men and organizations. It explains in part, and certainly with objectivity, some of the schisms within our own ranks, such as the disagreement between Mr. Pinchot and the highly respected William B. Greeley over the practice of forestry on privately owned lands. Among younger foresters, born to a security-seeking age in which conformity has become the supreme virtue, this account of a man willing to fight to the point of physical and mental exhaustion for a "cause" may provoke some soul-searching.

R. D. FORBES
Consulting Forester
Ambler, Pa.

Regions, Resources, and Economic Growth

By Harvey S. Perloff, Edgar S. Dunn, Jr., Eric E. Lampard, and Richard F. Muth. 716 pp. Illus. The Johns Hopkins Press, Baltimore, Md. 1960. $12.

There is an interacting relationship between economic growth and the utilization of natural resources. An understanding of this interconnection is necessary to a comprehension of economic growth, and this publication attempts to provide this understanding.

The book is concerned with economic growth in the United States and with variations in economic growth between the states and regions of this country. It is one of a series resulting from Resources for the Future studies.

The principal author cites two objectives for the books: (1) ". . . to furnish information and insights that might be of value to the . . . groups concerned with various aspects of economic growth and decline as well as with natural resources," and (2) ". . . to provide a conceptual and methodological framework as a guide for our own (the authors') future research in resources and regions and for possible use by scholars. . . ."

Economic growth is viewed under two major aspects: *volume* and *welfare*. Volume growth is concerned with population, employment, and total income changes, whereas welfare growth is measured by changes in the economic level of individuals or families—primarily by changes in per capita income.

Part I of the book is concerned with definitional matters as well as a summary review of economic growth from 1870 to 1957. An additional chapter concentrates on growth in the 1939-1954 period.

Following this review, the theoretical basis and analytical techniques of the study are presented in Part II. A chapter in this part is also devoted to a summary of the entire volume.

The main consideration of Part III is the structural changes in volume of economic activities. The narrative of Part III is broken down into a number of periods: (1) prior to 1870, (2) 1870-1910, and (3) 1910-1950.

In Part IV an intensive analysis of economic change, primarily in terms of employment shifts, is made for the 1939-1954 period. One or more chapters are devoted to mining, agriculture, manufacturing, and service activities.

In both Parts III and IV changes in forest-based activities (forest employment and forest-products manufacturing) are analyzed and placed in perspective in the over-all picture.

The welfare aspects of economic growth are treated in Part V. Income and income differences provide the basis for the analysis. Interstate differentials in income level and rates of change are described and analyzed as are intra-industry, interstate differentials. One chapter considers factors causing differences in income.

To support its historical review and the analysis the book lists 200 text tables and 25 appendix tables. The 96 figures are, in the main, poor examples of legibility. It requires a determined reader to get through to the interesting analyses that the authors make of this great mass of data. It should be noted that, because of limitations of data and available research resources, the analytical job was only partially realized.

EDWARD T. SULLIVAN
University of Florida,
Gainesville

Look to the Wilderness

By W. Douglas Burden. 251 pp. Illus. Little, Brown and Company, Boston. 1960. $6.50.

Siwashing is from Siwash, an Alaskan word for Indian, and means to camp light, the way the Indians do with nothing but rifle, fry pan, tea pail, salt, tea, and sourdough. It is a rugged life. Douglas Burden has spent much of his career hunting and adventuring in far places, and most of it was done siwashing.

His account of these adventures begins while he was still a boy in Quebec. In the 1920's he and a companion went after big game in Alaska. Over the years he collected trophy animals for the American Museum of Natural History. His travels took him to the Far East, to Indochina for tiger, to the Himalayas for ibex, to the East Indies for the Komodo lizard, to Nicaragua's Mosquito Coast for a lost silver mine.

Whether writing about glaciers, barren mountain peaks, dense jungle, tropical rain forest, or the north temperate woods, he communicates sensitivity for the wild, and for wilderness values, that permits the reader to share vicariously in his experiences.

Although not one to seek hardship for hardship's sake, he apparently enjoyed conditions that most men would find uncomfortable or even painful. It is his belief that "Some of the greatest experiences of life involve struggle with the elements. It is good to get soaked through and frozen and half-starved and exhausted and even lost, for these are the common experiences of man's past."

The special effect of this book is aptly stated in Roy Chapman

Andrews' Introduction: "The author's sensitive appreciation of nature, his beauty of expression and vivid descriptions, will awake nostalgic memories and give a very special happiness to all lovers of the Lone Trail."

Highly recommended.

HENRY CLEPPER

❦❦❦

Pulp and Paper Chemistry and Chemical Technology (2nd ed.) Vol. I: Pulping and Bleaching

By James P. Casey. xix+580 pp. +95 pp. index. Illus. Interscience Publishers, Inc., New York and London. 1960. $19.50.

Nine years after the appearance of the first edition of *Pulp and Paper* by James P. Casey it has seemed advisable to publish a second edition, enlarged and revised, because of the considerable advances which have been made in the technical aspects of the pulp and paper industry. There has been a tremendous increase in the utilization of paper and paperboard during this period and, as the author mentions, many of these products have been the result of research by technical men. The greatest development has taken place in the areas of pulping, sheet formation, and coating.

The second edition of *Pulp and Paper* will consist of three volumes of which only the first volume, that on pulping and bleaching, is presently available. The first edition appeared in two volumes.

The chapter headings of Volume I are Cellulose and Hemicellulose, Lignin, Pulpwood, Pulping, and Bleaching. These headings are the same as in the first edition but, whereas the original first five chapters only occupied 321 pages, they now require 580 pages, or the entire volume except for the index. The chapter on pulping is nearly doubled in size and occupies about one-half of Volume I. This enlargement reflects the strong technical advances made by the pulp and paper industry in the past decade.

The chapter on pulpwood is of most immediate interest to foresters. Some of the general characteristics of pulpwood which should be considered in evaluation studies are discussed under these headings: Species of wood, physical characteristics of the cord, anatomy of wood, physical properties of wood, minor chemical components of wood (the major constituents are discussed in chapters I and II), and the history of wood. It is, of course, impossible to present thorough coverage of this area in a chapter of only 34 pages. Yet, for the most part, the author has done a commendable job in introducing the subject matter to the industrial chemist.

Unfortunately, there are certain inaccuracies such as the generalization "gymnosperms or evergreens and angiosperms or deciduous trees." And in Table I the density of softwoods is given as 21-26 lb./cu.ft. This spread of values would not include the southern pines (29-35 lb./cu.ft.), which constitute about 60 percent of all pulpwood consumed annually in the United States, or the coast form of Douglas-fir (29 lb./cu.ft.). However, later in the chapter, Casey does put the southern pines in their proper density relationship, so one suspects that certain points of revision may not have been checked adequately. Considering the broad scope of this book and the fact that there is only one author it is not surprising to find such occasional slips. Despite such shortcomings it may be said, in general, that the author has done well in his effort to prepare a book which would present various fundamentals of the pulp and paper industry to the advanced student and also serve as a reference book. This volume would be a useful one for the specialist in wood utilization to have on his bookshelf.

IRVING H. ISENBERG
The Institute of Paper Chemistry, Appleton, Wis.

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General

The Anatomy of Plants. By P. Font Quer. Tr. by D. H. R. Newton. 128 pp. Illus. Harper, New York 16. 1960. Science Today Series No. 3. $2.25.

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A Manual of Instruction for Log Scaling and the Measurement of Timber Products. Idaho State Board for Vocational Education and State Advisory Committee for Log Scaling. 112 pp. Illus. Idaho State Board for Vocational Education, Boise. 1960. VO-ED No. 38. $3.50.

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Protecting Bulk-Piled Green Lumber from Fungi by Dip Treatment. By T. C. Scheffer and J. T. Drow. 14 pp. Tables, chart. U. S. Forest Products Lab., Madison 5, Wis. 1960. Report No. 2201.

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Adhesives, Their Use and Performance in Structural Lumber Products. By M. L. Selbo. 17 pp. Table. U. S. Forest Products Lab., Madison 5, Wis. 1960. Report No. 2199.

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Wood Adhesives, a Summary of Their Properties and Uses. 6 pp. Tables. Australia Commonwealth Scient. and Indus. Research Org., Melbourne. 1960. Div. of Forest Prod. Trade Cir. No. 49.

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Society Affairs

First Call for Council Nominations

All members are hereby notified that the regular biennial election will be held December 2, 1961. A president, vice president, and nine other members of the Council will be elected for the two-year term 1962-1963.

The present Council is listed in the box below. Any or all of these incumbents may be renominated, provided they accept the nomination in writing.

President C. A. Connaughton has announced that he will not be a candidate for re-election.

Membership on the Council is restricted by the Constitution to Members (formerly Senior Members) and Fellows. Any Member or Fellow is eligible to hold office who is in good standing and who accepts the nomination in writing and declares his willingness to serve if elected.

Each voter will have an opportunity to ballot on all candidates for office. Council members are elected in accordance with the system of proportional representation. The procedure of proportional representation will be explained in a later issue of the JOURNAL. It is the system by which the Society has been electing Council members for more than two decades.

Table 1 shows the distribution of Council members by states during the past eight biennial terms of office (1946-1961).

Candidates for the office of president are voted on separately; the candidate who receives the highest vote is declared elected president, and the candidate who receives the next highest vote is declared elected vice president. Thus all candidates for president are considred as nominated also for vice president.

How Nominations Are Made

The Constitution (Article VIII, Section 2) states the conditions under which nominations are made by petition.

1. Each petition shall name but one candidate.

2. All candidates must be eligible to hold elective office.

3. A petition shall bear the signatures of at least ten voting members who at the time of signing the petition are eligible to vote in the coming election. (Eligible voting members are Junior Members, Members, and Fellows in good standing.)

4. A voting member may not sign more than one nominating petition for president or more than one nominating petition for a member of the Council. That is, he may sign two, but no more.

5. Petitions must be in the Society office by September 16, 1961.

The Society has no special form for submitting nominating petitions. They may be written as follows:

We, the undersigned voting members of the Society of American Foresters, hereby nominate John Doe, a Member (or Fellow) for the office of president (or member of the Council) for the two-year term 1962-1963.

The form of acceptance of a nomination may read as folows:

I accept the nomination to the office of President (or to membership on the Council) of the Society of American Foresters for the two-year term 1962-1963, and agree to serve if elected.

No nomination will be considered valid unless supported by the nominee's acceptance in writing which should be attached to the nominating petition.

All nominating petitions should be sent promptly to the Society office, 425 Mills Building, 17th Street at Pennsylvania Avenue, N. W., Washington 6, D. C. The executive secretary will gladly provide information about nominating or election procedure.

Aecording to the Constitution (Article VIII, Section 1) a Nominating Committee has been appointed by President Connaughton. The Committee is composed of the following members:

Officers and Council 1960-1961

CHARLES A. CONNAUGHTON, *President*
U. S. Forest Service
630 Sansome Street
San Francisco 11, Calif.

B. E. ALLEN
Union Bag-Camp Paper Corp.
P. O. Box 570
Savannah, Ga.

WILLIAM C. BRAMBLE
Department of Forestry and Conservation
Purdue University
Lafayette, Ind.

DONALD E. CLARK
U. S. Forest Service
Federal Center, Building 85
Denver 7, Colo.

HENRY J. MALSBERGER, *Vice President*
Southern Pulpwood Conservation Association
900 Peachtree Street, N.E.
Atlanta 9, Ga.

KENNETH P. DAVIS
School of Natural Resources
University of Michigan
Ann Arbor, Mich.

GEORGE A. GARRATT
School of Forestry
Yale University
New Haven 11, Conn.

WILLIAM D. HAGENSTEIN
Industrial Forestry Association
1410 S.W. Morrison Street
Portland 5, Ore.

HENRY CLEPPER, *Executive Secretary*
Mills Building, 17th Street at Pennsylvania Avenue, N.W.
Washington 6, D. C.

SVEND O. HEIBERG
College of Forestry
State University of New York
Syracuse 10, N. Y.

RICHARD J. PRESTON, JR.
School of Forestry
North Carolina State College
Raleigh, N. C.

CHARLES L. TEBBE
U. S. Forest Service
Federal Building
Missoula, Mont.

Chairman, Seth G. Hobart, Virginia Division of Forestry, Box 3347, University Station, Charlottesville, Va.

William A. Davies, School of Forestry, Oregon State College, Corvallis, Ore.

Elmer W. Shaw, Rocky Mountain Forest and Range Experiment Station, Forestry Building, Colorado State University, Fort Collins, Colo.

Ardie D. Toler, Woodlands Department, International Paper Company, Mobile 9, Ala.

Lee B. Winner, 426 South Bartlette Street, Shawano, Wis.

This committee is charged with the following duties:

1. To set the date of the election. (December 2, 1961, is the date.)

2. To provide for at least two candidates for the office of president, and at least nine candidates for membership on the Council.

3. To receive separate nominating petitions for the office of president and for each member of the Council, and to supplement such petitions when necessary with other nominations in order to comply with item 2 above.

The Nominating Committee will make no nominations of its own unless the voting membership fails to make the required minimum number of nominations by petition. Voting members should accordingly get busy and make their own nominations. For their information the distribution of Council members by states during the period 1946-1961 is shown in Table 1.

Nominations Received

On the date of going to press the following nominations had been received:

For President

B. E. Allen, Savannah, Ga. (Council Member 1956-1957, 1958-1959, 1960-1961.)

Paul M. Dunn, New York, N. Y. (Council Member 1946-1947, 1948-1949.)

J. Herbert Stone, Portland, Ore. (Council Member 1954-1955, 1956-1957, 1958-1959.)

For the Council

Archie E. Patterson, Athens, Ga.

SETH G. HOBART, *Chairman*
Nominating Committee

TABLE 1.—DISTRIBUTION OF COUNCIL MEMBERS BY STATES DURING PERIOD 1946-1961
(Presidents' names are in capital letters; vice presidents, in italics)

State	1946-1947	1948-1949	1950-1951	1952-1953	1954-1955	1956-1957	1958-1959	1960-1961
Alabama			Porter, Earl	Porter, Earl				
California		Nelson, DeWitt	Nelson, DeWitt	Thompson, P. A.	*Nelson, DeWitt*	NELSON, DEWITT	Connaughton, C. A.	CONNAUGHTON, C. A.
						Vaux, H. J.	Vaux, H. J.	
Colorado		Spencer, J. W.					Clark, D. E.	Clark, D. E.
Connecticut						*Garratt, G. A.*	GARRATT, G. A.	Garratt, G. A.
Dist. of Columbia								
Florida		McArdle, R. E.	McArdle, R. E.	McArdle, R. E.				
Georgia	Evans, C. F.	*Evans, C. F.*	EVANS, C. F.			Coulter, C. H.	Allen, B. E.	Allen, B. E.
					Coulter, C. H.	Allen, B. E.	*Malsberger, H. J.*	*Malsberger, H. J.*
Idaho	Evenden, J. C.	Evenden, J. C.						
Illinois	Coffman, J. D.							
Indiana								
Louisiana								
Maine						Briegleb, P. A.	Briegleb, P. A.	Bramble, W. C.
Michigan	ALLEN, S. W.		Demeritt, D. B.	Demeritt, D. B.	Demeritt, D. B.			
Minnesota			Fontanna, S. G.		Fontanna, S. G.	Fontanna, S. G.	Davis, K. P.	Davis, K. P.
Missouri			Kaufert, F. H.	Kaufert, F. H.				
Montana				Westveld, R. H.	Westveld, R. H.			
New Hampshire					Hanson, P. D.			
New Mexico	Herr, C. S.	Herr, C. S.	*Herr, C. S.*	Lindh, C. O.				Tebbe, C. L.
New York			Lindh, C. O.					
North Carolina	Reeknagel, A. B.				Illick, J. S.	Illick, J. S.		
Oregon	Damtoft, W. J.			*Demmon, E. L.*	DEMMON, E. L.			Heiberg, S. O.
	Dunn, P. M.	Dunn, P. M.	Brundage, F. H.		Stone, J. H.	Stone, J. H.	Hagenstein, W. D.	Preston, R. J.
								Hagenstein, W. D.
Pennsylvania							Stone, J. H.	
South Carolina						Goddard, M. K.	Goddard, M. K.	
Tennessee		Flory, C. H.						
Washington		Baker, W. M.						
	Greeley, W. B.	Greeley, W. B.	Marckworth, G.	DRAKE, G. L.		Heacox, E. F.	Heacox, E. F.	
	Martin, C. S.	MARTIN, C. S.		Marckworth, G.				
Wisconsin	Price, J. H.			Brown, W. J.	Brown, W. J.			

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First Call for Fellow Nominations

All members (formerly Senior Members) and Fellows of the Society are hereby advised that nominations for the grade of Fellow are now open. The election of Fellows will be held at the time of the Society's regular biennial election, December 2, 1961.

As defined by the Constitution (Article III, Section 7), "Fellows shall be foresters recognized generally throughout the profession as persons who have rendered outstanding service to forestry and to the Society. They shall be elected from the Members."

Nominations by Petition

The procedure for placing Members in nomination for the grade of Fellow is by petition. The Society has no printed form for this purpose; the petition may be typewritten thus:

We, the undersigned Members and Fellows of the Society of American Foresters hereby nominate John Doe for election to the grade of Fellow in 1961.

Remember these simple rules:

1. A petition may not name more than one nominee.

2. It must be signed by not less than 25 Members or Fellows in good standing.

3. It must be accompanied by a factual, not eulogistic, biographical sketch of at least 300 words giving an account of the nominee's professional career and accomplishments.

4. It must be received in the executive office of the Society, 425 Mills Building, 17th Street at Pennsylvania Avenue, N.W., Washington 6, D. C., not later than September 16, 1961.

The executive employees of the Society cannot be responsible for obtaining signatures on partially completed petitions or on petitions incomplete by reason of unacceptable signatures (that is, signatures of other than Members and Fellows in good standing). Only those nominees' names will appear on the ballot whose petitions are complete and valid in all details as of September 16, the closing date.

Election Procedure

Fellows are not elected by the membership at large, but by a board of electors which consists of all present Fellows, the Council, the chairmen of the 22 Sections, and the chairmen of the 10 subject Divisions.

The system is described in Article IV, Section 4 of the Constitution. To win election a nominee must receive an affirmative vote of not less than one-half the total number of votes cast, as provided in Bylaw 11.

For the 1961 election there will be 135 electors, of whom 94 are Fellows. An elector has one vote only. Thus, a Fellow who is also a Council member has but one vote.

Significance of the Grade

The highest membership distinction that can be conferred by the Society, this grade is awarded in recognition of outstanding service to forestry and to the Society. Fellows do not pay increased dues; their dues are the same as those of Members.

Since the Society was founded in 1900, there have been 125 Fellows elected. At the present time the number of living Fellows is 94.

List of Fellows

The current roster of Fellows follows. The state in which each Fellow is domiciled and the year of his election are shown after his name.

Allen, Shirley W. California. 1948.
Allison, John H. Minnesota. 1959.

Bailey, Reed W. Utah. 1955.
Baker, Frederick S. California. 1949.
Boyce, John S. Connecticut. 1955.
Brundage, Frederick H. Oregon. 1949.

Carter, E. E. District of Columbia. 1942.
Chapman, Herman H. Connecticut. 1922.
Clapp, E. H. District of Columbia. 1930.
Clepper, Henry. Virginia. 1949.
Coffman, John D. California. 1946.
Connaughton, C. A. California. 1959.
Coulter, C. Huxley. Florida. 1957.
Cowan, Charles S. Washington. 1957.
Cox, William T. Minnesota. 1953.

Damtoft, W. J. North Carolina. 1951.
Dana, Samuel T. Michigan. 1935.
Demeritt, Dwight B. Maine. 1955.
Demmon, E. L. North Carolina. 1951.
Detwiler, Samuel B. Virginia. 1955.
Drake, George L. Washington. 1953.

Dubuar, James F. New York. 1957.
Duffield, J. W. Washington. 1959.
Dunn, Paul M. New York. 1959.

Eldredge, Inman F. Florida. 1942.
Evans, Charles F. Georgia. 1949.
Evenden, J. C. Idaho. 1953.
Eyre, F. H. Virginia. 1959.

Ferguson, J. A. Pennsylvania. 1949.
Fischer, Arthur F. California. 1940.
Fontanna, Stanley G. Michigan. 1955.
Frank, Bernard. Colorado. 1957.
Fritz, Emanuel. California. 1951.
Frothingham, E. H. California. 1942.

Garratt, George A. Connecticut. 1953.
Garrison, Paul M. Louisiana. 1957.
Gill, Tom. District of Columbia. 1948.
Granger, C. M. Maryland. 1946.
Guise, Cedric H. New York. 1951.
Guthrie, John D. Virginia. 1942.

Hall, J. Alfred. Oregon. 1955.
Harper, V. L. District of Columbia. 1959.
Hartley, Carl P. Pennsylvania. 1949.
Hawes, Austin F. Connecticut. 1939.
Hawley, Ralph C. Arizona. 1942.
Heacox, Edwin F. Washington. 1957.
Heiberg, Svend O. New York. 1957.
Heintzleman, B. Frank. Alaska. 1951.
Hosmer, Ralph S. New York. 1932.
Hunt, George M. Wisconsin. 1951.

Illick, Joseph S. New York. 1946.
Isaac, Leo A. Oregon. 1953.

Jeffers, Dwight S. Oregon. 1948.

Kaufert, Frank H. Minnesota. 1955.
Keen, Frederick P. California. 1955.
Kelley, E. W. California. 1949.
Kellogg, Royal S. Florida. 1949.
Kinney, Jay P. New York. 1942.
Kircher, Joseph C. Florida. 1957.
Kittredge, Joseph. California. 1953.
Korstian, C. F. North Carolina. 1942.
Krueger, Myron. California. 1951.

Lowdermilk, Walter C. California. 1955.
Lutz, Harold J. Connecticut. 1957.

Marckworth, G. D. Washington. 1955.
Marsh, R. E. District of Columbia. 1948.
Martin, Clyde S. Washington. 1948.
Mason, David T. Oregon. 1948.
McArdle, R. E. District of Columbia. 1953.
Merrill, Perry H. Vermont. 1957.
Metcalf, Woodbridge. California. 1953.
Meyer, W. H. Connecticut. 1959.
Munger, Thornton T. Oregon. 1946.
Munns, Edward N. California. 1949.

Nelson, DeWitt. California. 1957.

Orell, B. L. Washington. 1959.

Porter, Earl. Alabama. 1957.
Preston, J. F. District of Columbia. 1948.
Price, Jay H. Arizona. 1951.

Reynolds, R. R. Arkansas. 1957.

Sampson, A. W. California. 1959.
Schmitz, Henry Washington. 1940.
Schumacher, F. X. North Carolina. 1959.
Shirley, Hardy L. New York. 1951.
Show, S. B. California. 1948.
Siecke, E. O. Texas. 1946.
Sparhawk, W. N. New Hampshire. 1946.
Vaux, H. J. California. 1959.

Wahlenberg, W. G. North Carolina. 1957.
Wakeley, Philip C. Louisiana. 1957.
Watts, Lyle F. Oregon. 1946.
Wilm, H. G. New York. 1959.
Wirt, George H. Pennsylvania. 1948.

Ziegler, E. A. Pennsylvania. 1949.

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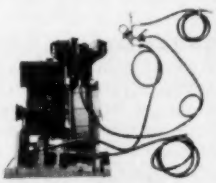

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Nominations Received

On the date of going to press the following nominations for Fellow had been received:

Robert S. Campbell, New Orleans, La.

Frank A. Albert, Jacksonville, Fla.

Council's Column

On Taking Action

Ever since becoming a member of the Society, when first eligible in 1938, the writer has marveled at our profession's seeming disinterest in guiding forest policy in America. Many articles in the JOURNAL OF FORESTRY have assured and reassured us in the last 20 years of the maturity of our profession. Maturity, in my judgment, carries with it responsibility for professional action in the policy field. Yet we hold annual meetings, scatter our members among the various subject Divisions which meet simultaneously, generally confine the General Sessions where all are present to the usual and necessary reports, avoid the issues of the day, adopt no policies and take no action, and go home vowing that we'll "do something about it" next year.

The writer's first contribution to this Column in April 1958 was entitled "Professional Responsibility" and made the plea for discussion of issues confronting the profession at the Annual Meetings. The plea was concluded by asking "... can our professional Society do less than study, discuss, and publicly state our professional viewpoint on all matters which will affect the timber, water, and wildlife resources and recreational opportunities of future generations?"

The favorable response to this plea from our members was gratifying and stimulating. It was summed up succinctly by former President Garratt in his contribution to the Council's Column in the JOURNAL OF FORESTRY for January, 1959 in which he said, "I find myself in substantial agreement with this call to the Society to face the need for free and open discussion and for action on controversial policy issues at the national as well as the Sectional level."

At the joint Section Delegate-Council meetings at San Francisco in 1959 and at Washington, D. C., in 1960 there was plenty of evidence from the grassroots that its members everywhere want the Society to discuss issues, take action and speak out on forest policy. At the latter meeting, just three months ago, the subject was discussed thoroughly under the title, "Formulation of Society Policy and Action to Implement It." The Executive Secretary pointed out that the Constitution and Bylaws provide the procedures for establishment of policy, i.e., by the Council, by petition of the membership for referral of any Council policy to the membership by mail ballot, referral to the membership by mail ballot on initiative of the Council, etc. He emphasized that resolutions adopted at Annual Meetings can *not* represent the membership, but only those present, as a majority of entire voting membership is required to formulate policy.

To meet the obvious desire of a majority of the membership for a more active and vigorous Society on the policy front, the writer offers the following suggestions, as he did at the Section Delegate-Council meeting in November.

1. Executive Secretary to solicit Sections for policy subjects for discussion at either General Session or Joint Section Delegate-Council meeting at next Annual Meeting. If no suggestions received, Council to suggest several current topics to Sections

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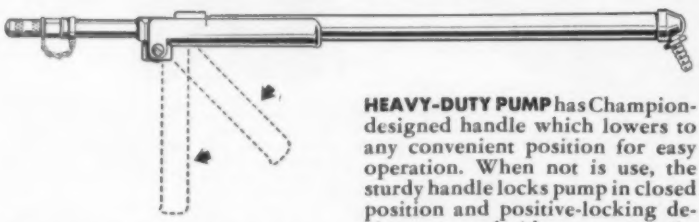

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with request that they and their Chapters discuss before Annual Meeting.

2. Take Section action on such of these issues as Section membership desires.

3. Sections to authorize their official delegates to Annual Meeting to report any Section action taken to either General Session or Section Delegate-Council meeting.

4. Before Annual Meeting is adjourned Council to take action in accordance with wishes of majority of the Sections and within framework of its authority under the Constitution and Bylaws.

5. If Council has insufficient authority to act, refer matter to membership immediately by mail ballot.

The urgency of modifying our procedure for taking action is now. If the Society of American Foresters is to represent the forestry profession adequately, it must do so courageously, honestly, and currently. Otherwise the future of sound land use policy and management may be in unsafe hands.

W. D. HAGENSTEIN

Your Opinion, Please!

On page 126 is a *We Present* sketch titled "Thomas N. Busch and the Buschmaster." This is a departure from the customary type of JOURNAL article in that it attempts to tell about an interesting mechanical development in forestry in terms of the man who designed it.

In view of the expressed desire of the membership for more articles of general professional interest, the comments of readers will be appreciated.

ARTHUR B. MEYER,
Editor

Ozark and Kentucky-Tennessee Sections Hold Joint Meeting

A joint meeting of the Ozark and Kentucky-Tennessee Sections was held December 1-3, 1960, in the Peabody Hotel, Memphis, Tenn. One hundred ninety-seven SAF members were in attendance.

The program of the December 2 all-day session, under the chairmanship of W. Z. Hawkins, consisted of two half-day meetings, a luncheon, and a banquet. The morning was devoted to a program dealing with the objectives, purposes, and organization of the SAF. President Charles A. Connaughton addressed the group and was followed by a panel discussion of "Organization" with Russ Reynolds as moderator. Albert Engstrom and Archie E. Patterson discussed, respectively, Society-Section and Section-Chapter relationships. Executive Secretary Henry Clepper spoke on SAF organization and representation.

During the afternoon a panel discussion on "Communication" was moderated by Kenneth Seigworth. Richard Smith spoke on the subject of stimulating understanding of national forestry issues; Kenneth P. Davis, SAF

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Council member, discussed the role of subject matter divisions in the Society; and JOURNAL editor Arthur B. Meyer discussed Society publications.

Luncheon speaker was Dr. Chauncey D. Leake, president of the American Association for the Advancement of Science, who outlined the role of a professional society. At the evening banquet, preceded by a social hour, G. W. E. Nicholson, president of the Tennessee River Pulp and Paper Co., was principal speaker. Recognition awards by the Kentucky-Tennessee Section were made to Wilson Wyatt, Kentucky lieutenant governor, and Sam Nickey, Memphis, for "contributions to forestry over and above the demands of their regular employment."

The business meeting of the Ozark Section was held the evening of December 1 and that of the Kentucky-Tennessee Section on the morning of December 3. At the latter new officers were installed as follows: Chairman—James Warmbrod, Jackson, Tenn., succeeding Thomas F. Ramke; vice-chairman—O. M. Davenport, Lexington, Ky.; and seceretary-treasurer—John F. King, Berea, Ky.

During the meeting a brief joint business session was held at which the following petition to the Council was read and approved:

Petition to the Council

Society of American Foresters, for a Study of the Constitution and By-Laws in the Light of Modern Developments in Forestry

At our annual meeting in Washington last month, the keynote addresses, which presumably are somewhat of a guide to the Society's activities for the coming year, stressed the rapid growth of the multiple-use concept. This was expressed in McArdle's paper, "Horizon's Unlimited," and has been recognized in legislation passed by Congress as affecting the management of federal lands.

Since the Society in the past has assumed a rather narrow approach in defining its objectives and membership requirements, it is probably time that the Council set up a committee to take a very careful look at the constitution and by-laws to see whether or not these coincide with the modern concept of forestry and are compatible with the kind of program and standards which the Society members are attempting to promote.

Multiple use includes many things and considerable discretion will be needed in determining which special fields can be included in the membership of the Society. We have already eliminated the utilization group, which has set up the Forest Products Research Society; we have practically eliminated the range management and wildlife groups, since they cannot meet the junior membership requirements, except in a few instances; and it is possible that because of the high degree of specialization developing in various fields of forestry others will be eliminated unless our SAF entrance requirements are in some way changed.

It is suggested that a Council committee reassess the objectives of the Society, define what is meant by forestry (which is lacking in the present constitution), determine what our new objectives are, and then so organize the Society and define its membership requirements in such manner that the Society of American Foresters may continue to provide the kind of leadership to the whole forestry program, nationally, as it has done in the past. If the present trend continues, it is feared by some members that the Society of American Foresters may be becoming more and more narrow, tending toward a concentration in silviculture, and if such a trend continues that we may eventually lose leadership in the over-all forestry field. In the light

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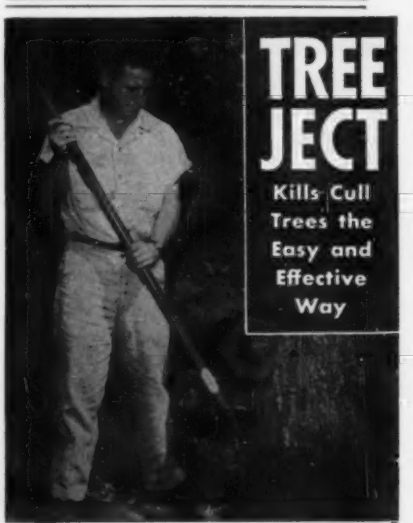

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of this, the following resolution is offered:

RESOLVED: That the Kentucky-Tennessee Section and the Ozark Section in meeting assembled jointly petition the Council of the Society of American Foresters to give a serious study to the objectives of the Society, a definition of forestry, membership requirements and organization of the Society, and determine whether any changes and/or reorganization would better meet the needs of modern forestry and enable the Society of American Foresters to better continue its future leadership in the forestry movement in the United States.

George B. Hartman (1894-1960)

George Bernhardt Hartman, 65, of Ames, Iowa, died November 25, 1960. He was head of the Iowa State University Department of Forestry until his retirement last year.

Prof. Hartman was born in Valley Junction, Iowa, November 28, 1894. He studied forestry at Iowa State College, receiving the B. S. degree in 1917 and the M. S. degree in 1941.

GEORGE B. HARTMAN

Following service in the Army during World War I, he became a specialist in wood preservation for the Long-Bell Lumber Company, rising to general superintendent of production at the DeRidder, La., plant.

In 1935 he was appointed professor of forestry at Iowa State College where he served during the rest of his professional career. In 1948 he was named head of the Department of Forestry.

As a Member of the Society of American Foresters, he was active in educational affairs. He was secretary, later chairman, of the Division of Education, and served for several years on the Committee for the Advancement of Forestry Education. He was elected a Fellow of the Society in 1959.

W. Kay Conard (1904-1960)

W. Kay Conard, 56, of Everglades, Fla., died December 6, 1960, after an extended illness.

Born in Philadelphia, Pa., October 11, 1904, Mr. Conard attended Friends Central School and Drexel Institute, and received a B.S. in forestry from Pennsylvania State College in 1928.

For the past seven years he has served as forester for the Collier Company and was instrumental in starting experimental planting of eucalyptus and mahogany trees, as well as other fast growing trees in Collier County, Fla. Previously he had served as forester for the Southern Railway System and the Tennessee Valley Authority. He had recently returned from a trip to India where he went as a consultant for the Point 4 program for the U. S. government.

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Biological Research Award Criteria and Procedure

In 1954 the Society of American Foresters received a grant of $10,000 from an anonymous donor. The purpose was to finance awards to be made by the Council "in recognition of outstanding achievement in basic or applied research in any branch of the biological sciences, provided the research contributes, either directly or indirectly, to the advancement of forestry."

The Council set up a Council committee to consider eligibles for awards. The current members are Kenneth P. Davis, chairman; S. O. Heiberg, and Charles L. Tebbe.

Past awards have been made as follows:

Leo A. Isaac of Portland, Ore., in 1956.

Philip C. Wakeley of New Orleans, La., in 1956.

Harold J. Lutz of New Haven, Conn., in 1957.

C. Syrach Larsen of Denmark, in 1957.

Nicholas T. Mirov of Berkeley, Calif., in 1958.

Francis X. Schumacher of Durham, N. C., in 1959.

At its meeting on November 13, 1960 the Council adopted the following statement concerning criteria and procedure. For further information on the establishment of the award, see JOURNAL OF FORESTRY 54:280-281.

The biological research award is made annually or at longer intervals to a person in recognition of outstanding achievement in basic or applied research in any branch of the biological sciences, providing the research contributes, either directly or indirectly, to the advancement of forestry. Persons in any country and of any race, color or creed shall be eligible for an award. Organizational affiliation is not a consideration. Biological sciences are interpreted to include wood technology not essentially engineering in character. The basic aim is to seek out and recognize outstanding work within the purview of the award and to honor principal contributors. The award consists of a specially designed plaque and a check presented to the recipient at an annual meeting of the Society.

The Council committee is responsible for maintaining a current list, as complete as possible, of potential recipients including biographical materials. Nominations can be made to the committee at any time by any member of the Society. A permanent open file is maintained.

Not less than 30 days prior to a Council meeting at which Biological Research Awards are to be considered, the committee submits to the Council the names of from three to five persons for consideration with information on each including the following:

Name, address, age.

Present title and position.

Education; academic degrees.

Honors, awards, or other scientific recognition.

Employment; major positions held, foreign travel, study, or special assignments as pertinent.

Major publications; books and other writings.

Membership and participation in scientific, learned, and professional societies.

Field of research.

Research accomplishments.

In making nominations to the Committee on Biological Research Awards, information on the above items is desired together with letters of endorsement.

The next meeting of the Council is scheduled to be held April 20 and 21, 1961.

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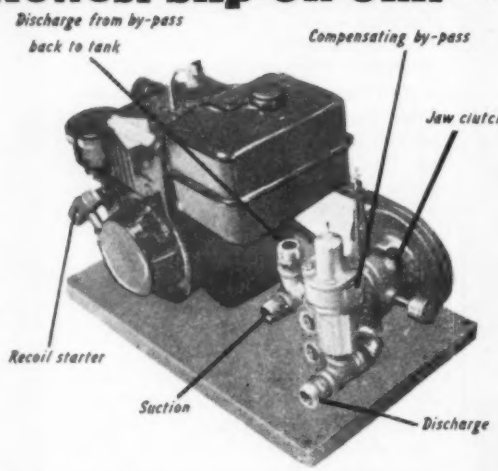

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Coming Events

SPCA Annual Meeting

The annual meeting of the Southern Pulpwood Conservation Association will be held at the Roosevelt Hotel, New Orleans, La., February 7-8, 1961.

Allegheny Section

The Allegheny Section will meet February 9-11, 1961, at the Lord Baltimore Hotel, Baltimore, Md.

Appalachian Section

The Appalachian Section will meet at the Hotel Roanoke, Roanoke, Va., February 10-11, 1961.

American Pulpwood Association

The American Pulpwood Association will meet February 20-24, 1961, at the Roosevelt, Hotel, New York City.

Central Rocky Mountain Section

The Central Rocky Mountain Section will meet at Fort Collins, Colo., February 24-25, 1961.

National Watershed Congress

The 8th National Watershed Congress will be held at the Ramada Inn, Tucson, Ariz., April 17-19, 1961.

Puget Sound Section

The Puget Sound Section will hold its Annual Section Meeting on April 28-29, 1961, at the Morck Hotel, Aberdeen, Wash.

Gulf States Section

The Gulf States Section will hold its annual meeting at the Edgewater Gulf Hotel, Edgewater Park, Miss., May 8-9, 1961.

Membership Applications and Advancements

Proposals for admission, advancement, and reinstatement received in the Society office during the month of December are listed below.

Action on the eligibility of those proposed for membership as listed below will be taken by the Council as of February 28, 1961.

Communications from the voting members regarding the membership eligibility of these persons should be received in the Society office prior to that date.

Alaska Section

Junior Grade

Howland, J. R., Forester, USFS, Ketchikan, Alaska, Univ. Idaho, BSF, 1959.

Member Grade

Sawyer, R. H., Forester, USFS, Ketchikan, Alaska (Junior 1954).
Schlapfer, T. A., Forest Supv., USFS, Ketchikan, Alaska (Junior 48R55).
Wright, G. G., Forester, Bureau of Land Mgmt., Juneau, Alaska (Junior 1954).

Allegheny Section

Student Grade

PENNSYLVANIA STATE UNIVERSITY
Solomon, D. S.

WEST VIRGINIA UNIVERSITY

Ayton, J. S.	Kelley, R. L.
Brittain, R. E.	Lantz, R. L.
Brodie, J. E.	Mallow, J. E.
Brooks, R. G.	Pirie, J. S.
Clendening, G. F.	Reilly, J. H.
Grund, V. A.	Reynolds, W. L.
Haynes, V. L.	Shires, C. D.
Hedrick, J. H.	Simon, J. F.
Hodson, W. J.	Tibbs, A. L.
Homa, R. C.	Wilson, A. D.
Kallgren, J. D.	Zaebst, O. C.

Member Grade

Coy, R. M., Service Forester, Pa. Dept. Forests & Waters, South Williamsport, Pa. (Junior 1954).
Eckert, P. L., Ass't. District Forester, Pa. Dept. of Forests & Waters, Fayetteville, Pa. (Junior 1954).
Kocjancic, E. F., Tbr. Operator, Self Employed, Wilcox, Pa. (Junior 1954).

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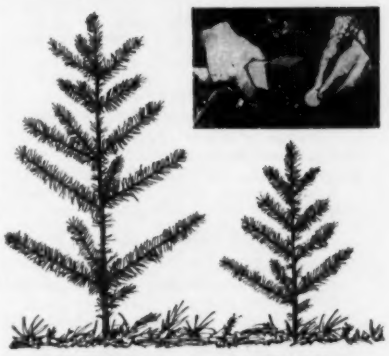

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Sears, G., Ass't. Sales & Operations Mgr., Weyerhaeuser Co., Harrison City, Pa. (Junior 1954).
Sydansk, R., Staff Consulting Forester, Armstrong Cork Co., Lancaster, Pa. (Reinstatement).

Appalachian Section

Student Grade

NORTH CAROLINA STATE COLLEGE
Tyson, G. S.

Junior Grade

Fox, C. A., Service Forester, N. C. Division of Forestry, New Bern, N. C. (Reinstatement).
Lane, C. L., Ass't. Prof., Clemson College, Clemson, S. C., N. C. State, BSF, 1952.

Member Grade

Curry, J. A., TVA Division of Forestry Relations, Asheville, N. C. (Junior 1954).
Dixon, J. R., Box 81, Bedford, Va. (Junior 1954).
Ellis, C. W., W. Va. Pulp Co., Summerville, S. C. (Junior 1954).

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Gross, D. F., W. Va., Pulp Co., Bedford, Va. (Junior 1954).
Heltzel, J. B., Associate Forester, Va. Division of Forestry, Charlottesville, Va. (Reinstatement).
Holmes, M. L., 3425 Cheyenne Rd., Raleigh, N. C. (Junior 1954).
Masten, J. C., 303 Powell Blvd., Whiteville, N. C. (Junior 53R55).
Peterson, R. W., W. Va. Pulp Co., Chester, S. C. (Junior 1954).
Sutton, R. F., Flack-Jones Lbr. Co., Moncks Corner, S. C. (Junior 1954).
Turner, R. G., The Chesapeake Corp., Amelia Court House, Va. (Junior 1954).
Welch, M. E., Consulting Forester, Fredericksburg, Va. (Junior 1954).
Wheless, J. H., Camp Division, Union Bag-Camp Paper Corp., Louisburg, N. C. (Junior 53R55).

Affiliate Grade

Farmer, J. D., Tree & Brush Control Supv., Va. Electric & Power Co., Richmond, Va.

Central Rocky Mountain Section

Student Grade

COLORADO STATE UNIVERSITY
Beckman, R. E.

Junior Grade

Miller, J. C., Forest Supv., USFS, Steamboat Springs, Colo. (Reinstatement).
Shannon, L. A., Ass't. Ranger, USFS, Ft. Collins, Colo., Colo. State, BSF, 1960.

Member Grade

Boldt, C. E., Project Leader, Rapid City Research Center, Lincoln, Nebr. (Junior 1954).
Grover, J. D., Dist. Ranger, USFS, Colorado Springs, Colo. (Junior 50R55).
Johnson, R. G., Dist. Ranger, USFS, Sundance, Wyo. (Junior 1954).
Lake, R. M., Dist. Ranger, USFS, Bailey, Colo. (Junior 1954)
Miller, D. L., Dist. Ranger, USFS, Gunnison, Colo. (Junior 1954).
Nepp, J. F., Dist. Ranger, USFS, Del Norte, Colo. (Junior 1954).
Ripley, W., Ass't. Ranger, USFS, Glenwood Springs, Colo. (Junior 1954).
Simon, C. L., Ass't. Ranger, USFS, Gunnison, Colo. (Junior 1954).
Sullivan, R. D., Dist. Ranger, USFS, Custer, S. D. (Junior 1954).

Columbia River Section

Student Grade

OREGON STATE COLLEGE
Anderson, M. R. Chatten, T. A.
Mann, C. W.

Junior Grade

Bagley, L. J., Logging & Tbr. Mgr., U. S. Plywood Corp., Eugene, Ore. (Reinstatement).
Hanson, R. N., Traffic Mgr., Cascader Plywood Corp., Portland, Ore., Ore. State, BSF, 1950.
Yantis, R. A., Party Chief, Weyerhaeuser Co., North Bend, Ore. (Reinstatement).

Gulf States Section

Junior Grade

Macko, B. A., 406 So. College, Cleveland, Texas, Purdue Univ., BSF, 1955.

Affiliate Grade

Broussard, B. F., Dist. Supv., International Paper Co., Jefferson, Texas.
Hardage, T. W., Ass't. Dist. Ranger, USFS, Holly Springs, Miss.
Holmes, A. M., Mgmt. Forester, Mississippi Forestry Comm., Brookhaven, Miss.
Warnock, J. L., Forester, USFS, Alexandria, La.

Inland Empire Section

Student Grade

UNIVERSITY OF IDAHO
Faulkner, D. R.

Member Grade

Dahl, J. R., Forester, USFS, Coeur d'Alene, Idaho, State Univ. Mont. BSF, 1955 (Junior 1955).

Intermountain Section

Student Grade

UTAH STATE UNIVERSITY

Bills, S. W.	Murdock, C. M.
Burnette, J. A.	Taylor, K. F.
Johansson, R. O.	Webster, R. P.
Murdock, B.	Weeks, L. M.

Kentucky-Tennessee Section

Junior Grade

Barnitz, J. A., Forester, USFS, Erwin, Tenn., Colo. State, BSF, 1960.
Donovan, D. H., Branch Mgr., Southern Timber Mgmt. Service, Hixson, Tenn. (Reinstatement).

Member Grade

MacMaster, M. O., Mgr., Stanley Inc., Pulaski, Tenn. (Reinstatement).

New England Section

Student Grade

UNIVERSITY OF MAINE
Atkins, J. P.

UNIVERSITY OF NEW HAMPSHIRE
Scott, T. W. P.

Affiliate Grade

LaCasce, J. R., Service Forester, Maine Forest Service, Dover-Foxcroft, Maine.

New York Section

Student Grade

STATE UNIVERSITY OF NEW YORK
Lampman, M. V.

Junior Grade

Dosne, J. J. E., Section Mgr., Canadian Institute of Forestry, Toronto, Ontario, Canada, Yale Univ. MF, 1947.
Mulholland, W. D., Ass't. Director, New York Cons. Dept., Albany, N. Y. (Reinstatement).

Member Grade

Arsenault, R. D., Graduate Student, Syracuse, N. Y. (Junior 1954).

Northern California Section

Junior Grade

McComb, W. H., Resident Forester, Simpson Tbr. Co., Korbel, Calif., Univ. Wash., BSF, 1949.
Spencer, J. S., Ass't. Dist. Ranger, USFS, Mt. Hebron, Calif., State Univ. Mont., MF, 1954.

Ozark Section

Junior Grade

Jeffrey, B. G., Forester, International Paper Co., Sheridan, Ark. (Affiliate 1956).

Member Grade

Massengale, R. A., Farm Forester, Missouri Cons. Comm., Hannibal, Mo., Univ. Mo., BSF, 1956 (Junior 1956).

Affiliate Grade

Williams, P., Dist. Forester, Dierks Forests Inc., Grannis, Ark.

Puget Sound Section

Student Grade

UNIVERSITY OF WASHINGTON

Benson, D. A. Martinsen, M. W.
Bergvall, J. A. Wick, H. L.

Southeastern Section

Student Grade

UNIVERSITY OF GEORGIA

Anderson, G. J. Harris, J. B.
Bulloch, S. G. McCarty, T. M.
Futch, M. J. Stone, J. S.
Vines, J. V.

Member Grade

Allen, P. L., Consulting Forester, Brewton, Ala. (Junior 1954).

Cook, J. R., Chief Forester, Mobile, Ala. (Junior 1954).

Hogan, L. D., Forester, Dadeville, Ala. (Junior 1954).

Murphy, S. R., Owner, Murphy Furniture Mfg. Co., Inc., Jasper, Ala. (Junior 38R55).

Southern California Section

Junior Grade

Barton, C. E., Ass't. Forest Tech., Dept. of Natural Resources, Riverside, Calif., Univ. Wash., BSF. 1959.

Member Grade

Mendel, G. C., USFS, San Luis Obispo, Calif. (Junior 50R55).

Southwestern Section

Affiliate Grade

Reed, B. P., Ass't. Dist. Ranger, USFS, Globe, Ariz.

Upper Mississippi Valley Section

Student Grade

IOWA STATE UNIVERSITY

McGuire, R. L. Shadle, J. N.

UNIVERSITY OF MINNESOTA

Flanelly, R. R. Manion, P. D.
Johnson, B. E. Nosker, J. A.
Kauth, W. W. Ostrom, A. J.
Lindquist, H. A. Steiro, R. L.

Junior Grade

Kronberg, I. A., Forester, U. S. Steel Corp., Duluth, Minn. (Affiliate 1952).

Students Eligible for Automatic Advancement

IOWA STATE UNIVERSITY

Farris, W. A. Messerschmidt, D. K.
Goins, R. A. Onken, G. A.
Gottsacker, J. H. Sampson, G. R.
Halbleib, D. W. Youker, J. C.
Knupp, J. F.

Washington Section

Junior Grade

Hicks, L. D., Classification & Wage Specialist, USFS, Washington, D. C., Colo. State, BSF, 1951.

Member Grade

Lara, F. W., Supv., National Wildlife Federation, Washington, D. C., State Univ. N. Y., BSF, 1951 (Junior 1959).

Wisconsin-Michigan Section

Student Grade

MICHIGAN COLLEGE OF MINING & TECHNOLOGY

Eilertsen, D. N. Schinkler, R. A.
Walimaa, G. J.

MICHIGAN STATE UNIVERSITY

Foutz, C. F. Hartshorn, M. A.

Junior Grade

Rodgers, G. W., Ass't. Dist. Forester, Wisconsin Cons. Dept., Eau Claire, Wis. (Reinstatement).

Member Grade

Cody, J. B., Forest Entomologist, Kimberly-Clark of Mich., Inc., Kingsford, Mich. (Junior 1954).

Erickson, C. D., Ass't. Dist. Forester, Newberry Dist., Newberry, Mich. (Junior 1954).

Hamilton, G., Ass't. Dist. Forester, Michigan Cons. Dept., Newberry, Mich. (Junior 51R55).

Houston, D. R., Graduate Student, Univ. of Wisconsin, Madison, Wis. (Junior 1954).

Johnson, J. A., 654 Cedar Point Drive, Williams Bay, Wis. (Junior 1954).

Kreger, P. B., Dist. Forester, Newberry Dist., Newberry, Mich. (Junior 1954).

Lassen, L. E., 216 Westmorland Blvd., Madison, Wis. (Junior 1954).

Peterson, H. S., Dist. Forester, Mich. Cons. Dept., Iron Mountain, Mich. (Junior 48R55).

Tubbs, C. H., Research Forester, USFS, Marquette, Mich. (Junior 1954).

Ystesund, K. A., Mgr., Michigan Northwoods Club, Ishpeming, Mich. (Junior 1954).

Associate Grade

Geary, T. F., Research Ass't., Univ. of Wisconsin, Madison, Wis.

No Section

Corresponding Grade

Antonio, D. U., Forester, Dept. of Agric., Manila, Philippines.

Burns, L. V., F.A.O. Forestry Officer, F.A.O., Caracas, Venezuela.

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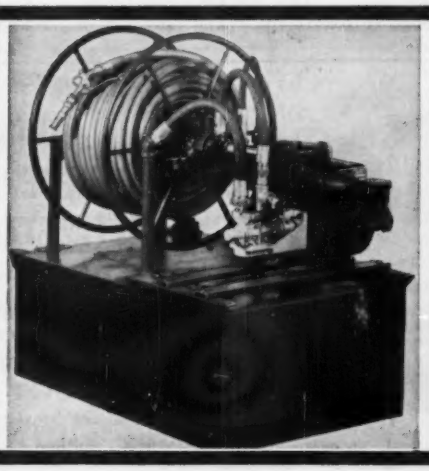

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Forestry News

Forest Service to Take Over Remainder of Klamath Indian Lands

Some 525,750 acres of the Klamath Indian Forest in southern Oregon will become a part of the National Forest System on April 1, 1961, under the Klamath Termination Act of 1958.

This Act provided for the sale of certain lands to reimburse members withdrawing from the Klamath Indian tribe. About 145,000 acres of the forest land involved were retained and managed by Indians who elected to remain in the tribe. The remainder of the forest (approximately 617,000 acres) was offered for sale, with the Forest Service responsible for establishing conditions of sale and accepting bids. Deadline for bidding was December 1, 1960.

Although a number of industries presented plans for purchase of the lands, only one company—Crown-Zellerbach Corporation—closed a mutually satisfactory contract. This purchase was of the Antelope Desert Unit, a 91,539-acre tract of land, appraised at $1,636,182.

Under agreement made with the Klamath Indian tribe, the Forest Service will purchase the remainder of the block of land.

Western Forestry Association Meets

The theme of the 51st annual meeting of the Western Forestry and Conservation Association, held December 7-9, 1960, at Victoria, B. C., was "Forest Frontiers of the Sixties." The conference brought together some 500 industrial timberland managers and landowners. Considerable attention was given over to the timber resources and problems of the two new states, Alaska and Hawaii, as well as underdeveloped regions in Canada.

Carrying the frontier theme further, such topics as forest fire research, utilization of fire weather data, Alberta's protection developments, and the unique protection problems of Alaska were spotlighted.

The relationship of people to forest frontiers provided an interesting feature of the program. Trends in forest recreation, policies on public land, integrated use of public forests, and the impact of public opinion on frontier development provided thought-provoking material for the assembly.

Dr. Chauncey Donald Orchard, who retired in 1958 as deputy minister of forests and chief forester for British Columbia, received the annual Western Forestry Award plaque from Conference President Hugh J. Hodgins, Crown-Zellerbach Canada Ltd.

South Continues Pulpwood Lead

The South led the world with a record pulpwood harvest in 1959.

The value of pulpwood in the South as raw material for the pulp and paper industry totaled $455,002,000, an increase of 12 percent over 1958, according to H. J. Malsberger, general manager of the Southern Pulpwood Conservation Association, in Atlanta.

This value was based on a 12-state pulpwood production survey by the U. S. Forest Service Experiment Stations in Asheville, N. C., and New Orleans, La., in cooperation with SPCA.

Georgia led the South for the twelfth straight year with total purchases of pulpwood valued at $94,702,000, 16 percent more than the pulpwood crop harvested in the state in 1958. Alabama was second with a crop valued at $58,620,000.

Pulpwood harvest values for the other southern states follow: Arkansas, $30,486,000; Florida, $42,268,000; Louisiana, $35,992,000; Mississippi, $40,316,000; North Carolina, $42,916,000; Oklahoma, $1,096,000; South Carolina, $38,666,000; Tennessee, $7,060,000; Texas, $28,312,000; and Virginia, $34,568,000.

The South harvested more pulpwood last year than all of the remainder of the United States; more than any other single country; and more than any other area of comparable size in the world.

"As the market for wood is extended to all parts of the South, more intensive forest development is made possible for the region by providing nearly every forest owner with even stronger incentive for managing his tree crop," Mr. Malsberger said.

11,000,000 Acres Set Aside in Alaska for Wildlife

Secretary of the Interior Fred A. Seaton on December 8, 1960, announced he had issued orders withdrawing some 11,000,000 acres of federal lands in Alaska for wildlife purposes.

The orders withdraw the Arctic Wildlife Range (8,900,000 acres) and the Kuskokwim (1,400,000 acres) and the Izembek (415,000 acres) waterfowl areas as ranges.

The Secretary proposed the establishment of the Arctic Wildlife Range

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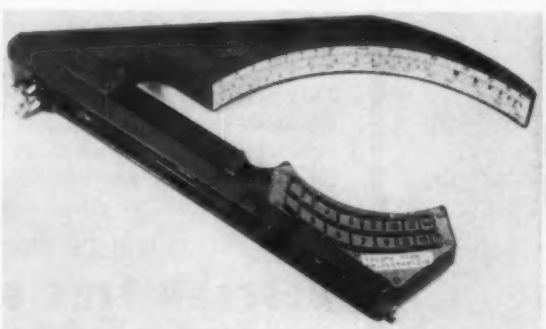

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some two years ago and a proposed withdrawal was published in the *Federal Register* of January, 1958. He, however, hoped to establish the area through legislation approved by the Congress in order to permit mining. A measure to establish the Arctic Wildlife Range passed the House during the 86th Congress but failed in the Senate.

The Arctic Wildlife Range is to be located in northeastern Alaska in an area not presently inhabited. Canada is expected to establish a comparable, and adjacent, area. The Ranges are needed to protect dwindling herds of Arctic Caribou, grizzly bears, Dall sheep, moose, marine animals, and nesting grounds for migratory waterfowl as well as to preserve a unique portion of the Arctic for scientific study.

The Kuskokwim and Izembek National Wildlife Ranges are located on Alaskan public domain lands. The Kuskokwim area is an important waterfowl nesting location. The Izembek region is a prominent congregating area for waterfowl.

Navy Steps up Forest Program; Opening for Top Forester

An insertion to the Defense Appropriations Act of 1961 enables the Navy to carry out its policy to restore, improve and preserve its forests in the public as well as the military interest. The act now permits reimbursement from the proceeds of sales of timber from military lands for all expenses incurred in the production of timber. Those provisions apply to Navy lands as a whole which means that improvement programs for young timber tracts not yet producing can be supported with proceeds from merchantable stands. The primary objective of the Navy's forestry management program is to manage for the improvement of their forested areas until they reach the maximum volume and quality which can be maintained in perpetuity through a sustained yield harvest. By so doing, the Navy intends to assure that the forests on its lands are held in public trust for the day when the defense of this country will no longer require Naval use of such lands.

Technical Policy Control for the Navy's forestry program is exercised through the Natural Resources Management Branch of the Bureau of Yards and Docks which seeks a staff forester to coordinate the program. The staff forester will be the principal technical authority of the Navy Department in matters pertaining to forestry management and the development and application of protective vegetative covers.

The position therefore calls for a professional forester who is nationally recognized as a leader and an authority in his profession and who has had extended training and experience in plant technology. Applications will be accepted until March 1, 1961. All inquiries should be addressed to the Personnel Office, Bureau of Yards and Docks, Navy Department, Washington 25, D. C. (See ad on page 160, this issue.)

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Arnold Appointed Forester The Collier Company

Kenneth B. Arnold has been appointed forester of the Collier Company, Everglades, Fla., replacing the late W. Kay Conard, according to an announcement by Norman A. Herren, general superintendent.

A native of Ohio, Mr. Arnold served as assistant to Mr. Conard for five years after receiving his degree in forestry from the University of Florida.

Foreign Timber Consultant Added by U. S. Plywood

In order to meet its present and future needs for rare and conventional woods, United States Plywood Corporation has announced the appointment of Bruce F. Lamb to the newly created post of foreign timber consultant.

Lamb will be responsible for the worldwide search for, and evaluation of, timber supplies for the wide variety of wood products produced by the plywood company. He will make his initial headquarters in Santurce, Puerto Rico.

Among the rare woods currently imported by U. S. Plywood for use in its hardwood wall panel line are: Korina, DeMartine, and Palisandro from the Belgian Congo; and Brazilian Rosewood, Benak, and Negrito from South and Central America.

A former superintendent at the company's logging operations in Panama, Lamb holds a Ph.D. in tropical forestry from the University of Michigan.

Since 1954 he has served as an independent researcher and consultant to the lumber industry.

Ehinger Heads Division of Hines Co.

Paul F. Ehinger has been appointed general manager of the Westfir Division of the Edward Hines Lumber Co., Westfir, Ore. The announcement was made by Charles M. Hines, president of the company. The Hines Lumber Co. operates a plywood plant, sawmill and logging department at Westfir. They also operate other Oregon plants at Hines, Seneca, Bates, Baker, and Dee as well as a wood products engineering and development laboratory at Hood River.

Ehinger, the new manager at Westfir, is a native Oregonian born in Portland. He is a graduate forester of the University of Michigan (1946), and served three years in the Marines

during the second World War receiving a second lieutenant's commission.

Ehinger has been associated with the Edward Hines Lumber Co. at Westfir since 1949, except during fourteen months service as a first lieutenant in the Korean war (1951-1952). He is chairman of the public timber sale committee of The Industrial Forestry Association, member of the Board of Directors of the Oregon Logging Congress and The Pacific Logging Congress, and a member of the SAF.

New Consulting Firm Formed

A new forestry consulting firm has been announced in Jackson, Miss. A group of technical foresters have formed Forestry Consultants, Inc., to handle all forms of timber management including tree planting, forest inventories, land surveying, timber sales, and preparation of resource surveys for cities interested in attracting wood-using industries to their area. They specialize in both pine and hardwood forestry.

Purvis R. Huff will head the new company as president and John W. Squires, Sr., will serve as chairman of the board. Its office will be located in the Dale Building, 2906 North State Street, Jackson, Miss., from which it will serve the southeastern states.

Schools

Yale Marks 60th Anniversary

The 60th anniversary of the Yale University School of Forestry, whose alumni are deans and heads of half of the nation's forestry schools, was celebrated with a special two-day program November 10 and 11, 1960.

Highlighting the program, which emphasized worldwide scientific forestry developments during the last ten years, was a banquet held at the New Haven Lawn Club.

Arthur W. Greeley, Class of 1935, acted as toastmaster. Other speakers included Norman S. Buck, Provost of Yale University, and Samuel T. Dana, Class of 1904 and dean emeritus of the School of Natural Resources at the University of Michigan, who spoke on "Education of Tomorrow's Forester."

The anniversary celebration of the school, oldest in continuous operation in the country, started with registration and open house at Sage-Bowers Hall and the Greeley Laboratory. Alumni and guests then attended seminars at the Greeley Laboratory on wood technology and forest tree improvement.

On the second day the Yale Forest School Alumni Association held a business meeting. Presiding at the meeting was David E. Hanaburgh, Class of 1939 and the Alumni Association's vice president. After an informal luncheon at University Commons, Alumni and guests toured experimental areas and stands of interest of the Eli Whitney Forest. The two-day celebration closed with a reception at Sage-Bowers Hall.

Scholarships Awarded to LSU Forestry Students

Louisiana State University forestry students were awarded three scholarships by lumber industry firms at an annual honors day convocation held here.

Organizations awarding annual scholarships to students of the School of Forestry are the King Lumber Industries of Baton Rouge, La., Calcasieu Paper Company of Elizabeth, La., and Homelite, a division of Textron, Inc., of Port Chester, N. Y.

The newly-established King Lumber Industries of Baton Rouge Forestry Scholarship in the amount of $1,000 will be awarded annually on the basis of scholarship and need to a deserving and competent undergraduate or graduate student of the School of Forestry.

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Recipient of the first annual award is graduate student James W. Murphy, Hico, La.

The annual Calcasieu Paper Company Scholarship of $600 and the Homelite Scholarship in Agriculture with a stipend of $500 are awarded to forestry students on the basis of leadership, scholarship and need, according to Dr. Paul Y. Burns, LSU School of Forestry.

Recipient of the Calcasieu Paper Company award is Roy C. Beltz. Samuel N. Saxon is the 1960-1961 recipient of the Homelite scholarship.

Mississippi State Forestry Dean Appointed

Assistant Dean Robert T. Clapp has been appointed dean of the School of Forestry at Mississippi State University effective February 1, 1961, in a reorganization of the Division of Agriculture. The Extension Service, Experiment Station, School of Agriculture, and School of Forestry will become separate agencies each reporting to the president's office. A newly created position of vice president for Agriculture and Forestry will provide assistance to the President in the coordination and administration of these functions.

Penn State Scholarships Announced

Two Glatfelter Pulp Wood Company Scholarships of $500 each and two Homelite Forestry Scholarships of $250 each were recently awarded to students in the School of Forestry at The Pennsylvania State University. The occasion was the annual Ag Hill Party at Penn State where $22,230 in scholarships and awards went to 106 students in the College of Agriculture.

Dr. Robert E. McDermott, head of the Department of Forest Management, made the awards for the Glatfelter Pulp Wood Company to Werner K. Bruckner, senior, and to Kenneth H. Hickok, junior in forestry.

Mr. J. H. Maxwell, Jr., sales promotion manager of Homelite, presented his company's scholarships to J. Robert Stottlemeyer, senior, and to Gordon M. Heisler, junior in forestry.

Wood Science and Technology Programs Advance

Dr. Fred E. Dickinson, director of the University of California's Forest Products Laboratory at Richmond, has been appointed head of the Society of Wood Science and Technology's visiting scientist program.

Under the program, outstanding wood scientists will be brought to some 40 university and college campuses in the United States during the next three years to meet with faculty and students interested in this field of work.

The executive board of the Society also has named Dickinson a member of an eight-man steering committee which will guide a study of education in wood science and technology to be made in the next two years.

Both projects will be financed with grants from the National Science Foundation.

Public

Dixie National Forest Is Enlarged

The Dixie National Forest in Utah has been enlarged by almost 12,000 acres as the result of an executive order signed by President Eisenhower. The order divides lands formerly administered by the Departments of Agriculture and Interior in the Widtsoe Land Utilization Project. Under the order, 11,783 acres of federal lands are added to the Dixie National Forest and 14,825 acres are to be managed by the Department of the Interior as public domain.

Hanlon Succeeds Redding as North Carolina USFS Supervisor

Hugh S. Redding, a veteran of 38 years federal service, retired from the U. S. Forest Service in December as supervisor of North Carolina National Forests. He is succeeded by Peter J. Hanlon, according to an announcement by J. K. Vessey, regional forester of the Southern Region, USFS.

A native of North Carolina, Redding started working part time with the Forest Service in Idaho in 1922, but most of his years have been spent in the South where he has been supervisor at various times of National Forests in Louisiana, Arkansas, Geor-

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gia, Mississippi, and North Carolina.

He worked two years in research on mechanical control of forest fires in the West in 1930 and 1931, helping to perfect fire plows.

He is a graduate of the University of Montana, class of 1931, with a B.S. degree in Forestry.

Redding plans to move from Asheville, N. C., to Leesville, La., where he will become a private consultant in forestry management and public relations.

Hanlon, who has 26 years with the U. S. Forest Service, transferred to Asheville, N. C., from the Eastern Regional Office of the Forest Service in Upper Darby, Pa.

A native of Syracuse, N. Y., Hanlon graduated from the New York State College of Forestry in 1929. He was first employed as a consulting forester with private industry, then entered government service in 1934 on the Allegheny National Forest in Pennsylvania as supervisor of a CCC encampment.

In 1936 he took charge of a ranger district on the Monongahela National Forest in West Virginia, and for the next 10 years served in capacities of increasing responsibilities.

His immediate past assignment was as a management analyst officer in the Division of Operations in Upper Darby, Pa.

Dorman Cited for Tree Improvement Work

Keith W. Dorman of the Southeastern Forest Experiment Station, Asheville, N. C., recently received a cash award for outstanding work.

Dorman, a research forester, was cited for achievements in forest genetics and breeding improved strains of southern pine which are attracting increased attention, not only from American, but also foreign foresters.

The citation read: "For originality in defining genetic problems and creating plans for their solution. Dorman's long association with the work and his widespread reputation for predicting fruitful avenues of exploration have advanced the prestige of the Southeastern Station, the Forest Service and the Department of Agriculture."

Joseph F. Pechanec, Station director, presented the award.

Products Research Specialist Retires

A 31-year career in research at the U. S. Forest Products Laboratory, Madison, Wis., ended November 30, 1960, with the retirement of Ralph O. Marts, technologist in the Division of Timber Growth and Utilization Relations.

During his long tenure at the Laboratory, Marts is credited, among other accomplishments, with the development of various techniques in the use of incident-light microscopy and photomicrography, some of which have been adapted also for use in medical research. His work in preparing specimens and photographing the microstructure of wood earned him international recognition. He has done extensive research on growth quality relations, the structure and characteristics of wood and crown control of southern pines and its relationship to formation of springwood in the growth ring.

In World War II, Marts spent more than three years in the Air Force, much of it as a photo-interpreter in the Mediterranean theater and the Rhineland campaign. He earned a B.S. degree in biology from Ottawa University in Kansas and an M.S. degree, in botany, from Iowa State University.

F. B. Folsom Retires

Frank B. Folsom, assistant regional forester of the U. S. Forest Service in Portland, Ore., retired as the chief of the Division of Recreation.

Folsom was born in Tennessee but moved to the West at an early age, and received his forestry training at the University of Idaho. Following three years of military duty, of which 22 months were spent in France during World War I, he joined the Forest Service in June 1952 on the Colville National Forest in northeast Washington. Following a variety of assignments he was promoted in 1936 to forest supervisor of the Ochoco National Forest at Prineville, Ore. In 1942 he became supervisor of the Wenatchee Forest; and in September 1944 was promoted to chief of the Division of Recreation and Lands in the regional office.

Bell Transfers to Southern Station

Raymond G. Bell has been appointed assistant chief of the Division of Station Management at the Southern Forest Experiment Station. New Orleans. Bell, a member of the U. S. Forest Service since 1933, has held a similar position for the past two years at the Southeastern Forest Experiment Station. He succeeds David J. Mooney, who transferred to Missoula, Mont., in October 1960.

Bell served once before at the South-

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ern Station, from 1943 to 1948, as administrative officer. During that time, he earned a Superior Accomplishment Award for conceiving and preparing the Operations Handbook for Branch Stations, which is still in use.

D. J. Morriss Heads Planning Section

Donald J. Morriss has transferred to the position of chief, Timber Inventory and Management Planning Section, Division of Timber Management, Washington Office, U. S. Forest Service. He succeeds Larry S. Gross, who retired in July 1960.

Prior to his Forest Service appointment, Morriss was employed by the states of Pennsylvania and Florida and by the American Forestry Association on the Southern Forest Fire Prevention Program. Within the Service he has held the positions of cultural foreman, assistant district ranger, junior administrative assistant, district ranger, timber management forest and regional staff assistant, area forester on the Timber Production War Project, assistant forest supervisor, forest supervisor, management analyst, and assistant director of Internal Audit.

He received the degree of B. S. in forestry from North Carolina State College in 1930 and an M.A. in public administration from the American University in 1943. He has been awarded two citations for meritorious work performance.

Utilization Researcher Retires

Mark M. Lehrbas, chief of the Division of Forest Utilization, Southern Forest Experiment Station, retired from the U. S. Forest Service October 31, 1960. He had then completed over 32 years of forestry work in the U. S. Department of Agriculture. His retirement was announced by Philip A. Briegleb, director of the Southern Station.

Lehrbas received a B.S. degree in forestry from the University of Idaho in 1927. He began his career with the Forest Service in 1928 on the Ouachita National Forest.

Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiations.

Position Available

Opening in Navy for professional forester with experience and education in plant technology. To serve as principal technical authority in forest management. Must be recognized as leader and authority in the profession. Salary, $10,635, plus benefits. Apply to March 1, 1961 to Personnel Office, Bureau of Yards and Docks, Navy Department, Washington 25, D. C. (See news item page 155 this issue.)

Opening available September 1 for assistant professor of forestry. Required a doctor's degree obtained or expected. Age, under 45. Starting salary, $6,516-$7,176 for academic year (nine months) depending on professional preparation and experience. Subjects to be taught, forest and range hydrology, dendrology, and forest influences with emphasis on soils. **Apply to Dean of Instruction, Humboldt State College, Arcata, Calif.**

Positions Wanted

Forester, B.S. Pa. State, 1957. Age 25, married, 1 child, veteran. Experience: U.S.F.S. in Oregon and California. Project Sales Officer (Timber), general administration, recreation planning, watershed and wildlife management, range management plans and inventory, reforestation, and insect control. Will consider any forestry position in Northwestern U. S. **Box O, Society of American Foresters, 425 Mills Building, Washington 6, D. C.**

Forester, B.S. major in Forest y, University of Michigan, 1957. 1 summer with U.S.F.S. Recently discharged U.S. Army. Current F.A.A. Commercial Pilots license with single engine land and rotorcraft (helicopter) and instrument rating. Desire position with opportunity to learn and for advancement. Anywhere in U.S. Age 26, married, no children. **Box P, Society of American Foresters, 425 Mills Building, Washington 6, D. C.**

M.F., 5 years experience in forest products development seeks position in research center. Domestic or overseas position. Experienced in statistical design and analysis of experiments, translations, five foreign languages. Publications. Honor societies. Salary at least $10,000. Prefers Urban North. **Box Q, Society of American Foresters, 425 Mills Building, Washington 6, D. C.**

Forester with ten years experience in wildlife management and conservation teaching. M.F., Ph.D. in Zoology with research in population dynamics, six years meteorology in U.S. Air Force. Desire land management responsibility, or work in teaching, interpretation, research activity. **Box R, Society of American Foresters, 425 Mills Building, Washington 6, D. C.**

Forest Entomologist; B.S. Forestry, M.S. Entomology 1961. La. State Univ. Age 25, married, one child. One year inactive reserve to complete military obligation. One summer's experience with U.S.F.S., two year's experience under research assistantship at L.S.U. Entomology Research Dept. Research emphasized forest insects. Thesis research on control of Nantucket pine moth. Desire employment in South or Southeast. **Box S, Society of American Foresters, 425 Mills Building, Washington 6, D. C.**

Forester, B.S. 1955, State University of N. Y. Age 27, married, one child, Veteran. Graduate work at State University of N. Y. in silviculture, ecology. Fifteen months U.S.F.S.; road location, timber inventory, T.S.I., and all phases of timber sales. Experience in consulting forestry and in highway surveying. Desire position with future in Northeast. Will consider all locations. **Box T, Society of American Foresters, 425 Mills Building, Washington 6, D. C.**

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